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01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N74-20635 Stanford Univ., Calif.
A STUDY OF THE NONLINEAR AERODYNAMICS OF BODIES IN NONPLANAR MOTION Ph.D. Thesis
Lewis Barry Schiff 1973 90 p
Avail: Univ. Microfilms Order No. 74-6543

Concepts from the theory of functionals have been used to develop a formulation of the aerodynamic force and moment system for an arbitrarily shaped body that does not depend on a linearity assumption. The analysis, which proceeds formally once the functional dependence of the aerodynamic reactions upon the motion variables is established, ensures the inclusion, within the resulting formulation, of pertinent aerodynamic terms that normally are excluded in the classical treatment. When applied to the large-amplitude, slowly varying, nonplanar motion of a vehicle, the formulation suggests that the aerodynamic moment can be compounded of the moments acting on the body in four basic motions: steady angle of attack, pitch oscillations, either roll or yaw oscillations, and coning motion. Coning, where the nose of the body describes a circle around the velocity at constant rate, characterizes the nonplanar nature of the general motion.
Dissert. Abstr.

N74-20636# Aeronautical Research Inst. of Sweden, Stockholm.
A COMPUTER PROGRAM FOR THE PREDICTION OF AERODYNAMIC CHARACTERISTICS OF WING-BODY-TAIL COMBINATIONS AT SUBSONIC AND SUPERSONIC SPEEDS, PART 2
S. Anders and L. Gustavsson Nov. 1972 120 p refs
(FFA-AU-635-Pt-2) Avail: NTIS HC $9.00 CSCL 01A

A computer program for calculation of the aerodynamic characteristics of wing-body combinations at subsonic and supersonic speeds is described. The aerodynamic theory is outlined and several calculated examples with comparisons to experimental results are shown. A description of the computer program is provided together with a users manual. The results obtained show that the method is a very valuable tool for analysis and design purposes.
Author

N74-20637*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PRELIMINARY RESULTS OF FLIGHT TESTS OF VORTEX ATTENUATING SPLINES
Earl C. Hastings, Jr., Robert E. Shanks, Robert A. Champine, W. Latham Copeland, and Douglas C. Young Apr. 1974 41 p refs
(NASA-TM-X-71928) Avail: NTIS HC $5.25 CSCL 01A

Flight tests have been conducted to evaluate the effectiveness of a wingtip vortex attenuating device, referred to as a spline. Vortex penetrations were made with a PA-28 behind a C-54 aircraft with and without wingtip splines attached and the resultant rolling acceleration was measured and related to the roll acceleration capability of the PA-28. Tests were conducted over a range of separation distances from about 5 nautical miles (n. mi.) to less than 1 n. mi. Preliminary results indicate that, with the splines installed, there was a significant reduction in the vortex induced roll acceleration experienced by the PA-28 probe aircraft, and the distance at which the PA-28 roll control became ineffective was reduced from 2.5 n. mi. to 0.6 n. mi., or less. There was a slight increase in approach noise (approximately 4 db) with the splines installed due primarily to the higher engine power used during approach. Although splines significantly reduced the C-54 rate of climb, the rates available with four engines were acceptable for this test program. Splines did not introduce any noticeable change in the handling qualities of the C-54.
Author

N74-20638*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PRELIMINARY STATIC TESTS OF A SIMULATED UPPER-SURFACE BLOWN JET-FLAP CONFIGURATION UTILIZING A FULL-SIZE TURBOFAN ENGINE
James P. Shivers and Charles C. Smith, Jr. Mar. 1974 44 p
(NASA-TM-X-71931) Avail: NTIS HC $5.25 CSCL 01A

The investigation was conducted to evaluate the static turning performance and the pressure and temperature environment of an upper-surface-blown wing and flap utilizing a small turbofan engine. The tests involved modifications of the engine primary nozzle designed to alleviate high temperature problems on the wing and flaps and yet provide acceptable static turning performance over the desired range of flap deflections and thrust conditions.
Author

N74-20639# Advisory Group for Aerospace Research and Development, Paris (France).
TECHNICAL EVALUATION REPORT ON AGARD FLIGHT MECHANICS PANEL SYMPOSIUM ON FLIGHT IN TURBULENCE
W. S. Aiken, Jr. (NASA), Washington) and D. Lean (Roy. Aircraft Estab., Bedford, Engl.) Feb. 1974 10 p Conf. held at Woburn Abbey, Engl., 14-18 May 1973
(AGARD-AR-67) Avail: NTIS HC $4.00

The proceedings of a conference on the effects of atmospheric turbulence on flight characteristics are presented. The subjects discussed include the following: (1) turbulent environment, (2) operational problems, (3) design criteria, and (4) artificial aids for flight improvement. One conclusion is that there is a critical need for cross correlation measurements between various low atmosphere turbulence components. Additional discussion were held concerning wake vortex research for wake vortex detection and avoidance.
Author

N74-20640*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN INVESTIGATION OF SEVERAL NACA 1 SERIES AXISYMMETRIC INLETS AT MACH NUMBERS FROM

0.4 TO 1.29
Richard J. Re Washington Mar. 1974 143 p refs
(NASA-TM-X-2917; L-8588) Avail: NTIS HC $4.75 CSCL 01A

An investigation was conducted in the Langley 16-foot transonic tunnel to determine the performance of seven inlets having NACA 1-series contours and one inlet having an elliptical contour over a range of mass-flow ratios and at angle of attack. The inlet diameter ratio varied from 0.81 to 0.89; inlet length ratio varied from 0.75 to 1.25; and internal contraction ratio varied from 1.009 to 1.093. Reynolds number based on inlet maximum diameter varied from 3.4 million at a Mach number of 0.4 to 5.6 million at a Mach number of 1.29. Author

N74-20641# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Dynamik Verduennter Gase.
ABSOLUTE VELOCITY MEASUREMENTS IN A RAREFIED GAS FLOW BY AN ION TIME-OF-FLIGHT TECHNIQUE
K.-A. Buetefisch and D. Vennemann Aug. 1973 18 p refs Presented at the 8th Intern. Rarefied Gas Dyn. Symp., Stanford, Calif., Jul. 1972
(Contract DFG-BU-286/1)
(DLR-FB-73-115) Avail: NTIS HC $4.00; DFVLR, Porz, West Ger. 6.30DM

The method was applied to measurements in expansion flows at Mach numbers of about 20. The experimental results agree with predictions based on stagnation conditions within an error of less than + or - 1%. Measurements performed across a normal shock show that the method is suitable even if great velocity gradients are observed. Author (ESRO)

N74-20642# National Aerospace Lab., Amsterdam (Netherlands). Scientific Service and Special Project Div.
A NUMERICAL METHOD FOR THE DETERMINATION OF THE VORTEX SHEET LOCATION BEHIND A WING IN INCOMPRESSIBLE FLOW
T. E. Labrujere 7 Jul. 1972 52 p refs Sponsored by Neth. Agency for Aerospace Programs (NIVR)
(NLR-TR-72091-U) Avail: NTIS HC $5.75

Aiming at the determination of interference effects due to the wake of the wing, a numerical method was developed for the calculation of the vortex location behind a thick lifting wing. It may be considered as an extension of the NLR panel method for the determination of the pressure distribution on lifting wing-body combinations in subsonic flow. It comprises an iterative procedure for the determination of the vortex sheet location represented by discrete vortices for given onset flow conditions. Some features of the method, such as the effect of streamwise stepsize and discretization, were investigated numerically. A limited comparison was made with experimental results taken from work in progress. Author (ESRO)

N74-20643# Air Force Armament Lab., Eglin AFB, Fla.
A DISPERSION TECHNIQUE FOR THE MK82 BOMB Final Report, Jan. - Apr. 1973
Mark O. Schlegel and Page G. McGirr Jul. 1973 21 p refs (AF Proj. 1559)
(AD-773420; AFATL-TR-73-146) Avail: NTIS CSCL 19/4

Aerodynamic analyses and wind tunnel test data were used to investigate a new dispersion technique for general purpose and cluster bombs released on skids from cargo aircraft. Using the present approach, all bombs tend to impact in the same small area. The new technique involved the addition of a drag plate to the rear of the bomb fin assembly. The use of two sizes of plates (plus the standard configuration) would provide three ballistic trajectories for the bombs mounted on one skid. Author (GRA)

N74-20644# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AERODYNAMIC COMPARISON OF TWO DOUBLE-SLOTTED RUDDERS M.S. Thesis
Tyler B. Huneycutt, III Dec. 1973 150 p refs
(AD-774432; GAM/AE/73A-10) Avail: NTIS CSCL 01/3

Double-slotted rudders (DSR), proposed for an Advanced Medium STOL Transport by the L. O. M. Corporation and Convair Division of General Dynamics Corporation, were tested in a 7 X 10 ft wind tunnel at a dynamic pressure of 17.0 psf and a Reynolds number of 2,000,000. The rudders were tested in 5 deg increments of deflection from 0 to 40 deg, and at sidewash angles varying from -10 to +10 deg. In the range of deflection angles from 0 to stall, the Convair DSR design (DSR1) produced slightly higher side-forces; however, the L. O. M. DSR design (DSR2) stalled at a higher deflection angle than DSR1. Maximum side-force produced by DSR1 and DSR2 were almost exactly equal. The side-force versus sidewash angle curves were linear. A rudder deflection schedule for DSR2 was devised which produced minimum drag and linear side-forces. (Modified author abstract) GRA

N74-20645# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
APPLICATION OF THE LATERAL AND LONGITUDINAL (COUPLED) EQUATIONS OF MOTION TO AN INERTIALLY-SLENDER AIRCRAFT IN UNSYMMETRIC, RECTILINEAR FLIGHT M.S. Thesis
Charles W. McConnell Dec. 1973 93 p refs
(AD-774435; GAM/MC/73A-3) Avail: NTIS CSCL 01/1

The dynamics of an aircraft in flight may be represented by a set of six coupled non-linear equations of motion that are usually linearized about a symmetrical equilibrium position and divided into uncoupled lateral and longitudinal equations. The present high speed fighter aircraft requires a configuration that is prone to lateral instabilities which are not analyzed by the uncoupled equations. Solution of the coupled equations of motion is of considerable value because the cross-coupling effects may be determined and analyzed. For this study the F-4D aircraft was chosen as the physical model because of known stability difficulties. (Modified author abstract) GRA

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N74-20646* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AIRFLOW CONTROL SYSTEM FOR SUPERSONIC INLETS Patent
Glenn A. Mitchell, inventor (to NASA) and Bobby W. Sanders Issued 26 Mar. 1974 6 p Filed 11 Jun. 1971 Supersedes N71-34017 (09 - 21, p 3375)
(NASA-Case-LEW-11188-1; US-Patent-3,799,475; US-Patent-Appl-SN-152328; US-Patent-Class-244-53B; US-Patent-Class-137-15.1; US-Patent-Class-137-15.2) Avail: US Patent Office CSCL 01B

In addition to fixed and variable bleed devices provided for controlling the position of a terminal shock wave in a supersonic inlet, a plurality of free piston valves are disposed around the periphery of a cowling of a supersonic engine inlet. The free piston valves are disposed in dump passageways, each of which begin at a bleed port in the cowling that is located in the throat region of the inlet, where the diameter of the centerbody is near maximum, and terminates at an opening in the cowling adjacent a free piston valve. Each valve is controlled by reference pressure. Official Gazette of the U.S. Patent Office

N74-20647 Escher Technology Associates, St. Johns, Mich.
PROSPECTS FOR LIQUID HYDROGEN FUELED COMMERCIAL AIRCRAFT
William J. D. Escher Sep. 1973 39 p refs
(PR-37) Copyright. Avail: Issuing Activity

The use of hydrogen as a fuel for aircraft propulsion is discussed. The benefits of hydrogen with respect to air pollution reduction are analyzed. Liquid hydrogen as a potential future aviation fuel is considered to be the only practical chemical fuel producible from ultimate nonfossil energy primary sources. The

aerodynamic configurations and aircraft systems involved in hydrogen propulsion are described and illustrated. The facilities and processes for commercial production of hydrogen are reported. Author

N74-20648 Oklahoma Univ., Norman.
AERODYNAMICS OF CHANNEL AND RING WINGS Ph.D. Thesis
Roger Lair Smith 1973 259 p
Avail: Univ. Microfilms Order No. 74-6986

The results of a deflected streamtube theory for the lift and induced drag of isolated ring wings are briefly reviewed, and a similar theory for channel wings is presented. The ring wing theory, and methods derived from its general conclusions, are compared with other theoretical derivations and with experimental data. A wind tunnel test of two channel wings of aspect ratio 1.0 and 2.8 is described, and the data are compared with the channel wing deflected streamtube theory. It is shown that the ring wing theory yields good agreement with experiment and with other developments, but the channel wing deflected streamtube theory does not. The experimental results for channel wings and ring wings indicate that these wings achieve span efficiency factors of approximately 1.5 and 2.0, respectively. A lifting arc theory for channel wings is derived and shown to agree with the experimental data. Dissert. Abstr.

N74-20649 Texas Univ., Austin.
TRANSIENT AND STEADY-STATE RESPONSE OF FLEXIBLE ROTOR: REAL HYDRODYNAMIC BEARING SYSTEMS Ph.D. Thesis
Sherrell Theodore Myrick 1973 263 p
Avail: Univ. Microfilms Order No. 74-5297

A method is presented for the simulation of the transient and steady-state response of a flexible rotor support by realistic incompressible film hydrodynamic journal bearings. The rotor is composed of a series of rigid discrete-mass disks connected by massless shaft segments having the distributed elastic characteristics of a round beam. Shaft mass is included at the disk locations. External disk loading, gravity, disk and shaft inertia, and disk unbalance and gyroscopics are included in the general rotor model. No restrictions are placed on the size, shape, or location of the disk orbits, or on the rate of rotor precision. The bearings are assumed to be rigidly mounted. The coupled nonlinear ordinary differential equations of motion are formulated as an initial-value problem. Solutions are obtained by direct integration on a digital computer using the fourth-order Adams-Moulton predictor-corrector method, with the hydrodynamic bearing forces and moments being obtained for each time increment from a finite-difference solution of the general Reynolds equation. Dissert. Abstr.

N74-20650# National Aerospace Lab., Amsterdam (Netherlands).
ASPECTS OF AERONAUTICAL FATIGUE
J. Schijve Feb. 1973 29 p refs
(NLR-MP-73005-U) Avail: NTIS HC $4.50

The evaluation of the fatigue quality of an aircraft is discussed. The steps involved are as follows: (1) determination of the fatigue load environment, (2) response of the aircraft structure, (3) internal load distributions, and (4) estimation of the fatigue properties. The fatigue properties comprise fatigue life, crack propagation, and residual strength. The latter two items together with inspection procedures are qualifications for fail safe conditions. The influences of these factors on design efforts calculations, testing, inspections, and fatigue load monitoring are analyzed. Author

N74-20651*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ACOUSTIC LOADS ON AN EXTERNALLY BLOWN FLAP SYSTEM DUE TO IMPINGEMENT OF A TF-34 JET ENGINE EXHAUST
James A. Schoenster 10 Apr. 1974 20 p Presented at the 87th Meeting of the Acoustical Soc. of Am., New York, 23-26 Apr. 1974
(NASA-TM-X-71950) Avail: NTIS HC $4.00 CSCL 01C

One of the powered lift systems currently being considered for use on STOL vehicles obtains additional lift by impinging the flow of a jet exhaust on the flaps and turning it downward. This direct impingement subjects large areas of the flap to the fluctuating pressure loads of the turbulent jet flow; these loads have the potential for causing high vibration levels and sonic fatigue failures. A test was conducted on a full-scale mockup of an externally blown flap system, which consisted of a TF-34 engine and a section of a wing having a triple-slotted flap. Data were obtained and evaluated on the fluctuating pressures on the flaps and it is the purpose of this paper to present some of the results describing the loads. Author

N74-20652*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECT OF TRAILING-EDGE FLAP DEFLECTION ON THE LATERAL AND LONGITUDINAL-STABILITY CHARACTERISTICS OF A SUPERSONIC TRANSPORT MODEL HAVING A HIGHLY-SWEPT ARROW WING
Vernard E. Lockwood 19 Mar. 1974 55 p refs
(NASA-TM-X-71936) Avail: NTIS HC $5.75 CSCL 01C

A low-speed investigation has been made on a highly-swept wing model having a thickened leading edge to determine the effect of inboard trailing-edge flaps on the characteristics of the model in pitch and sideslip. The tests were made at a Mach number of 0.227 which corresponds to a Reynolds number of about 5.53 million based on the reference chord. The results showed that deflection of the trailing-edge flaps decreased the roll due to sideslip by about 20 percent at a landing lift coefficient of 0.5. The directional-stability parameter, was increased by deflection of the flaps and the range of lift coefficients over which it was positive was also increased. The longitudinal stability characteristics of the model without leading-edge devices were improved by increased flap deflection, that is, the pitch-up tendency was delayed to higher lift coefficients. The lift coefficient increment resulting from the 15 deg flap deflection compared favorably with that predicted. Author

N74-20653*# National Aeronautics and Space Administration. Langley Research Center, Laangley Station, Va.
APPLICATION OF COMPOSITES TO THE SELECTIVE REINFORCEMENT OF METALLIC AEROSPACE STRUCTURES
W. A. Brooks, Jr., E. E. Mathauser, and R. A. Pride Sep. 1972 17 p refs Presented at AGARD Symp. on Impact of Composite Mater. on Aerospace Vehicles and Propulsion Systems, Toulouse, 20-22 Sep. 1972
(NASA-TM-X-71939) Avail: NTIS HC $4.00 CSCL 01C

The use of composite materials to selectively reinforce metallic structures provides a low-cost way to reduce weight and a means of minimizing the risks usually associated with the introduction of new materials. An overview is presented of the NASA Langley Research Center programs to identify the advantages and to develop the potential of the selective reinforcement approach to the use of composites. These programs have shown that selective reinforcement provides excellent strength and stiffness improvements to metallic structures. Significant weight savings can be obtained in a cost effective manner. Flight service programs which have been initiated to validate further the merits of selective reinforcement are described. Author

N74-20654*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AERONAUTICAL FUEL CONSERVATION POSSIBILITIES FOR ADVANCED SUBSONIC TRANSPORTS
Albert L. Braslow and Allen H. Whitehead, Jr. 20 Dec. 1973 15 p
(NASA-TM-X-71927) Avail: NTIS HC $4.00 CSCL 01C

The anticipated growth of air transportation is in danger of being constrained by increased prices and insecure sources of petroleum-based fuel. Fuel-conservation possibilities attainable through the application of advances in aeronautical technology to aircraft design are identified with the intent of stimulating NASA R and T and systems-study activities in the various disciplinary areas. The material includes drag reduction; weight reduction; increased efficiency of main and auxiliary power systems; unconventional air transport of cargo; and operational changes. Author

N74-20655*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PRESSURE DISTRIBUTION OF A TWIN-ENGINE UPPER-SURFACE BLOWN JET-FLAP MODEL
Charles C. Smith, Jr. and Lucy C. White Mar. 1974 41 p refs
(NASA-TM-X-71937) Avail: NTIS HC $5.25 CSCL 01C

An investigation has been made to determine the chordwise and spanwise pressure distributions of a small-scale upper-surface blown jet-augmented flap STOL model. The model was powered by two simulated high-bypass-ratio turbofan engines mounted ahead of and above an unswept-untapered wing in a nacelle having a rectangular nozzle. The results of the investigation are presented as tabulated and plotted chordwise pressure distribution coefficients for nine spanwise stations. Author

N74-20656*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FREE-FLIGHT WIND TUNNEL INVESTIGATION OF A FOUR-ENGINE SWEPTWING UPPER-SURFACE BLOWN TRANSPORT CONFIGURATION Interim Report
Lysle P. Parlett Mar. 1974 36 p refs
(NASA-TM-X-71932) Avail: NTIS HC $5.00 CSCL 01C

The dynamic stability characteristics of a four-engine turbofan transport model having an upper-surface blown-jet flap have been investigated by means of the free-flight technique in the Langley full-scale tunnel. The flight characteristics of the model were investigated through a range of lift coefficients from 3 to 8 with all four engines operating and with one outboard engine not operating. Static characteristics were investigated by conventional power-on force tests over the flight-test angle-of-attack range and through the stall. Author

N74-20657*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPLORATORY TESTS OF A SIMPLE AERO-MECHANICAL RIDE COMFORT SYSTEM FOR LIGHTLY LOADED AIRCRAFT
Donald E. Hewes and Eric C. Stewart 14 Feb. 1974 20 p refs
(NASA-TM-X-71921) Avail: NTIS HC $4.00 CSCL 01C

Some exploratory wind tunnel and radio-controlled free-flight tests were made with a small high-wing airplane model (1.23m wing span) to study the concept of a simple aero mechanical system intended to alleviate gust loads and improve ride comfort of lightly loaded aircraft. The system consisted essentially of the outer portions of each wing being hinged in the chordwise direction and connected directly to the wing flaps using internal counter weights to provide neutral mass balance. When the wing experienced a change in velocity or angle of attack, the movable wing panels, acting as sensors and flap actuators, deflected in response to the changes in lift on the wing. The corresponding movements of the interconnected flaps tended to reduce the changes in the wing lift. Author

N74-20658*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXTERNAL STORE EFFECTS ON THE STABILITY OF FIGHTER AND INTERCEPTOR AIRPLANES
M. Leroy Spearman and Wallace C. Sawyer Mar. 1974 30 p refs
(NASA-TM-X-71935) Avail: NTIS HC $4.50 CSCL 01C

Some criteria for external carriage of missiles for fighter aircraft intended for aerial combat missions and for fighter-interceptor missions are considered. The mission requirements discussed include the short-range fighter-interceptor, the short-range interceptor, the medium-range interceptor, and the long-range interceptor. Missiles types considered to be compatible with the various point mission designs include the short-range missile, the medium-range missile, and the long-range missile. From the study, it appears that point mission design aircraft can be arranged in such a way that the required external-store arrangement will not impair the stability of the aircraft. An extensive reference list of NASA external store research is included. Author

N74-20659*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE NOISE ENVIRONMENT OF A SCHOOL CLASSROOM DUE TO THE OPERATION OF UTILITY HELICOPTERS
David A. Hilton and Robert J. Pegg 24 Apr. 1974 16 p refs Presented at 87th Meeting of the Acoust. Soc. of Am., New York City, 24 Apr. 1974
(NASA-TM-X-71957) Avail: NTIS HC $4.00 CSCL 01C

Noise measurements under controlled conditions have been made inside and outside of a school building during flyover operations of four different helicopters. The helicopters were operated at a condition considered typical for a police patrol mission. Flyovers were made at an altitude of 500 ft and an airspeed of 45 miles per hour. During these operations acoustic measurements were made inside and outside of the school building with the windows closed and then open. The outside noise measurements during helicopter flyovers indicate that the outside db(A) levels were approximately the same for all test helicopters. For the windows closed case, significant reductions for the inside measured db(A) values were noted for all overflights. These reductions were approximately 20 db(A); similar reductions were noted in other subjective measuring units. The measured internal db(A) levels with the windows open exceeded published classroom noise criteria values; however, for the windows-closed case they are in general agreement with the criteria values. Author

N74-20660*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECT OF ADVANCED AIRCRAFT NOISE REDUCTION TECHNOLOGY ON THE 1990 PROJECTED NOISE ENVIRONMENT AROUND PATRICK HENRY AIRPORT
Jimmy M. Cawthorn and Christine G. Brown 19 Feb. 1974 38 p refs
(NASA-TM-X-71953) Avail: NTIS HC $5.00 CSCL 01C

A study has been conducted of the future noise environment of Patric Henry Airport and its neighboring communities projected for the year 1990. An assessment was made of the impact of advanced noise reduction technologies which are currently being considered. These advanced technologies include a two-segment landing approach procedure and aircraft hardware modifications or retrofits which would add sound absorbent material in the nacelles of the engines or which would replace the present two- and three-stage fans with a single-stage fan of larger diameter. Noise Exposure Forecast (NEF) contours were computed for the baseline (nonretrofitted) aircraft for the projected traffic volume and fleet mix for the year 1990. These NEF contours are presented along with contours for a variety of retrofit options. Comparisons of the baseline with the noise reduction options are given in terms of total land area exposed to 30 and 40 NEF levels. Results are also presented of the effects on noise exposure area of the total number of daily operations. Author

N74-20661*# Boeing Commercial Airplane Co., Seattle, Wash.
THE 727 AIRPLANE SIDE INLET LOW-SPEED PERFORMANCE CONFIRMATION MODEL TEST FOR REFANNED JT8D ENGINES
A. L. Schuehle Mar. 1974 82 p refs
(Contract NAS3-17842)
(NASA-CR-134609; BCAC-D6-41521) Avail: NTIS HC $7.25 CSCL 01C

The results of a low-speed wind tunnel test of a 0.3 scale model 727 airplane side inlet for JT8D-100 engines are presented. The objectives of the test were to develop lines for a full-scale flightworthy inlet, to evaluate inlet total pressure recovery and steady-state total pressure distortion, and to obtain model-scale distortion data which can be used in the assessment of the compatibility of the inlet with the JT8D-100 series engines. A secondary objective was to obtain internal/external cowl static pressures for the determination of nacelle loads. Two basic inlet models were tested at static, forward speed, angle-of-attack (inflow angle), and cross-wind conditions. One model was with and one without an acoustic ring. Two modifications to the models were also tested, one with the ring closer to the inlet throat and one with a larger lip. Test measurements consisted of inlet surface static pressure, engine face total pressure, inlet airflow, tunnel total pressure, tunnel total temperature and tunnel velocity. Total pressure traverses were taken directly behind the ring and strut. No dynamic measurements were taken. Author

N74-20662*# Hughes Helicopters, Culver City, Calif.
COMPONENT NOISE VARIABLES OF A LIGHT OBSERVATION HELICOPTER
Frank Robinson [1973] 89 p refs
(Contract NAS2-7254)
(NASA-CR-114761; HH-73-41) Avail: NTIS HC $7.50 CSCL 01C

A test program was conducted to isolate and evaluate the individual noise sources of a light helicopter. To accomplish this, the helicopter was mounted on a special test rig, at a 6-foot skid height, in a simulated hover. The test rig contained by dynamometer for absorbing engine power and an exhaust silencing system for reducing engine noise. This test set-up allowed the various components of the helicopter to be run and listened to individually or in any combination. The sound pressure level was recorded at a point 200 feet from the helicopter as the component parameters were systematically varied. The tests were conducted in an open area, during the middle of the night, with no wind, and with all other known variables either eliminated or kept as constant as possible. Author

N74-20663*# Hughes Helicopters, Culver City, Calif.
NOISE LEVELS OF OPERATIONAL HELICOPTERS OF THE OH-6 TYPE DESIGNED TO MEET THE LOH MISSION
R. A. Wagner [1973] 70 p refs
(Contract NAS2-7254)
(NASA-CR-114760; HH-74-28) Avail: NTIS HC $6.50 CSCL 01C

Formulas relating overall sound pressure level (OASPL) to parameters such as horsepower required, tip speed, and thrust for main and tail rotors are presented for standard and quieted helicopters. Formulas relating OASPL to engine parameters such as horsepower output and percent power turbine rpm are presented for unmuffled and muffled engines. The linear scale was used in preference to any of the weighted scales because it resulted in more consistent agreement with the test data when the SPL is expressed in the usual parameters of tip speed, thrust generated and power required. It is recognized that the linear scale does not adequately reflect hearing response, and hence is not a good absolute measure for detection by humans. However, linear OASPL is believed to be useful as a relative means of comparing noise level variations of individual components in similar helicopters with reasonably modest design changes. Author

N74-20664# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORT: BRIEF FORMAT, US CIVIL AVIATION, ISSUE NO. 3 OF 1973 ACCIDENTS
25 Feb. 1974 522 p
(NTSB-BA-74-1) Avail: NTIS HC $29.25

This publication contains selected aircraft accident reports, in brief format, occurring in U. S. civil aviation operations during calendar year 1973. The 900 General Aviation and 22 Air Carrier Accidents contained in this publication represent a random selection. This publication is issued irregularly, normally six times each year. The brief format presents the facts, conditions, circumstances, and probable cause(s) for each accident. Additional statistical information is tabulated by type of accident, phase of operation, kind of flying injury index, aircraft damage, conditions of light, pilot certificate, injuries, and causal factors. Author

N74-20665# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORT: DELTA AIR LINES, INCORPORATED, DOUGLAS DC-9-31, N975-NE, BOSTON, MASSACHUSETTS, 31 JULY 1973
7 Mar. 1974 76 p
(NTSB-AAR-74-3) Avail: NTIS HC $7.00

A DC-9-31, crashed while executing an instrument landing system approach to runway 4R on the Logan International Airport, in Boston, Massachusetts. There were 83 passengers, 5 crewmembers and a cockpit observer on board. All occupants, except one passenger, were killed in the crash. The lone survivor, who had been injured critically, died later. The aircraft struck a seawall about 165 feet to the right of the extended runway centerline and about 3,000 feet short of the runway displaced threshold. The aircraft was destroyed. The National Transportation Safety Board determines that the probable cause of the accident was the failure of the flightcrew to monitor altitude and to recognize passage of the aircraft through the approach decision height during an unstabilized precision approach conducted in rapidly changing meteorological conditions. The unstabilized nature of the approach was due initially to the aircraft's passing the outer marker above the glide slope at an excessive airspeed and thereafter compounded by the flightcrew's preoccupation with the questionable information presented by the flight director system. The poor positioning of the flight for the approach was in part the result of nonstandard air traffic control services. Author

N74-20666*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LATERAL STATIC AND DYNAMIC AERODYNAMIC PARAMETERS OF THE KESTREL AIRCRAFT (XV-6A) EXTRACTED FROM FLIGHT DATA
William T. Suit and James L. Williams Washington Apr. 1974 43 p refs
(NASA-TN-D-7455; L-9176) Avail: NTIS HC $3.25 CSCL 01C

Flight test data have been used to extract the lateral static and dynamic aerodynamic parameters of the Kestrel aircraft. The aircraft configurations included thrust-jet angles of 0 deg, 15 deg, and 30 deg, and the test Mach numbers were 0.43, 0.62, and 0.82. The results showed that most of the parameters varied linearly with trim normal-force coefficient. The directional stability parameter showed a small increase with increasing trim normal-force coefficient and also with nozzle deflection. The effective-dihedral parameter, the damping-in-roll parameter, and damping-in-yaw parameter all increased (became more negative) with increasing trim normal-force coefficient. For the latter three parameters, the effect of nozzle deflection was dependent on the trim normal-force coefficient. Author

N74-20667*# General Electric Co., Evendale, Ohio.
THE EFFECT OF ENGINE COMPONENT NOISE ON V/STOL AIRCRAFT NOISE CONTOURS
R. G. Fogg Feb. 1974 118 p refs
(Contract NAS2-5462)
(NASA-CR-114687; R73AEG306) Avail: NTIS HC $9.00 CSCL 01C

An analytical study of fly-over noise using noise contours to show the effects of varying airplane and path parameters. The method of approach was to synthesize engine component noise spectra and exercise these components along given flight paths to measure the individual and total fly-over effect as a function of noise footprint area. The study was carried out in two phases. Phase 1 utilized a research type aircraft and Phase 2 used an advanced VTOL aircraft. The effect of cross flow was considered for both inlet and exhaust sections of the engine. Author

N74-20668*# Scientific Translation Service, Santa Barbara, Calif.
THE Do 31 LANDING LOADS DURING VERTICAL LANDING AND THEIR CONSEQUENCES FOR FUTURE V/STOL DEVELOPMENTS
W. Schoernack Washington NASA Apr. 1974 55 p refs Transl. into ENGLISH of "Die Landelasten der Do 31 bei Vertikallandungen und Folgerungen fuer zukuenftige VSTOL Entwicklungen", West Germany, report BMVG-FBWT-72-24, 1972 72 p
(Contract NASw-2483)
(NASA-TT-F-15532; BMVG-FBWT-72-24) Avail: NTIS HC $5.75 CSCL 01C

The results of 83 vertical landings carried out during the Do 31 V/STOL experimental program are presented. In 23 landings undercarriage reactions as well as sinking speeds were measured, of the remaining 60 landings only sinking speeds could be evaluated. Undercarriage reaction factors and sinking speeds are plotted as frequency distributions and are discussed. The result of the evaluation of the landing experiments can be summarized as follows: VTOL airplanes having a similar concept as the Do 31 and using manual control during the end of descent would experience considerably higher sinking speeds than conventional aircraft. The frequency distribution of the sinking speeds is very severe and sinking speeds below 1 m/sec do not occur. Author

N74-20669*# Kanner (Leo) Associates, Redwood City, Calif.
RESULTS AND INFORMATION OBTAINED REGARDING AERODYNAMIC JET INTERFERENCE ASSOCIATED WITH THE Do 31 V/STOL JET TRANSPORT AIRCRAFT AND THEIR APPLICATION TO FUTURE V/STOL DEVELOPMENT
D. Welte Washington NASA Apr. 1974 146 p Transl. into ENGLISH of "Ergebnisse und Erfahrungen zur aerodynamischen Strahlinterferenz beim VSTOL-Strahltransportflugzeug Do 31 und ihre Anwendung auf zukuenftige VSTOL-Entwicklungen", Dornier-Werke G.m.b.H., Friedrichshafen, West Germany, Report BMVG-FBWT-72-22, 1972 183 p
(Contract NASw-2481)
(NASA-TT-F-15533; BMVG-FBWT-72-22) Avail: NTIS HC $10.50 CSCL 01C

The most important results concerning jet interference effects for the Do 31 aircraft, resulting from wind tunnel model measurements and flight tests, are presented, and an estimation is given of jet interference effects for future V/STOL project studies. Calculations are based, on a single semi-empirical method for determination of jet induced lift loss in hovering for simple configurations such as the Do 31, and it is possible to calculate the lift loss to within 1% accuracy. The investigation of the jet induced flow field around the Do 31 during hovering with ground effect and in the transition flight regime yielded a rough estimation of the jet intereference effects for future V/STOL studies.
Author

N74-20670# Joint Publications Research Service, Arlington, Va.
USE OF THE METHOD OF VARIATION OF SIMILARITY CONSTANTS IN DESIGNING AIRCRAFT OVER THE LONG TERM
R. I. Vinogradov 7 May 1974 10 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Aviats. Tekhn. (Kazan), no. 4, 1966 p 68-74
(JPRS-61923) Avail: NTIS HC $4.00

The use of the method of variation of similarity contants is discussed. Mechanical models with complex boundary conditions are used as computing devices. Transformation to various full scale systems is achieved by math modelling. Author

N74-20671*# General Electric Co., Cincinnati, Ohio.
TF34 QUIET NACELLE NEARFIELD ACOUSTIC TEST RESULTS
W. E. Coward, E. B. Smith, and H. D. Sowers Mar. 1974 182 p refs
(Contract NAS3-17845)
(NASA-CR-134604; R73AEG417) Avail: NTIS HC$12.25 CSCL 01C

The results of the nearfield acoustic tests conducted on the TF34 Quiet Nacelle are presented. The high fan noise suppression levels being sought (26 PNdB reduction in aft noise) necessitated the use of an extensive system of special nearfield acoustic instrumentation to properly evaluate the suppression achieved. The design, operation, and test results from each of these nearfield acoustic instrumentation systems are presented.
Author

N74-20672*# Boeing Commercial Airplane Co., Seattle, Wash.
CRUISE DRAG RESULTS FROM HIGH SPEED WIND TUNNEL TESTS OF NASA REFAN JT8D ENGINE NACELLES ON THE BOEING 727-200
W. G. Easterbrook and R. B. Carlson Dec. 1973 42 p
(Contract NAS3-17842)
(NASA-CR-134546; D6-43099) Avail: NTIS HC $5.25 CSCL 01C

High speed wind tunnel test results are presented showing the cruise drag effect of installing JT8D-109 refan engines on a Boeing 727-200. Incremental drags of a refan center inlet and side nacelles are presented for several configuration variations. Static pressure distributions were obtained on the side nacelle strut and on the fuselage (above and below the strut). Oil flow photographs of selected configurations are also presented. In general the drag level of the refan installation is slightly better than predicted prior to the test and the drag rise is favorable.
Author

N74-20673# Institut Franco-Allemand de Recherches, St. Louis (France).
CALCULATION OF THE GEOMETRICAL PROPAGATION OF THE SONIC BOOM ALONG THE FLIGHT PATH ON THE GROUND UNDER REAL ATMOSPHERIC CONDITIONS WITH WIND [CALCUL DE LA PROPAGATION GEOMETRIQUE DU BANG SOUS TRACE DANS LE CAS D'ATMOSPHERES REELLES AVEC VENT]
M. Schaffar, C. Thery, and F. Schlosser 19 Dec. 1972 87 p refs In FRENCH
(Contract DRME-72/337)
(ISL-37/72) Avail: NTIS HC $7.50

The influence of real atmospheric conditions such as wind and temperature on the ground position of sonic boom carpet created by supersonic flight was investigated using programs for computation of acoustical propagations taking into account the meteorological parameters and examining longitudinal focalization and extinction points. The computation shows that the boom propagation distances along the aircraft axis trajectory are functions of the longitudinal component of the wind for the Mach number equal to 1. This distance for the extinction ray can reach three times the standard distance in backward wind conditions and half the standard distance in forward wind conditions. The horizontal ray trajectories leading to the focalization are varying with meteorological conditions. The incertitude on the boom carpet positions seems due to the imprecision on meteorological sounding and to the variation of atmospheric conditions between two successive soundings. ESRO

N74-20674# Loughborough Univ. of Technology (England). Dept. of Transport Technology.
THE CHARACTERISTICS OF TEN LIGHT HOVERCRAFT
D. Waters Nov. 1973 39 p refs
(TT-7312) Avail: NTIS HC $5.00

Light hovercraft covering a wide spectrum of craft from the best current (1972) racing designs to older designs approaching obsolescence were put through a standard series of tests to provide data for future comparisons and to test the accuracy of various simple theories in predicting characteristics. The average craft emerges as being 134 in. long, 75 in. wide, with a cushion pressure of 13.3 lb/sq ft, which is 1.5 times the value obtained by dividing the weight by the structural area. The structural clearance is 6.5 in., the mean air gap beneath skirt 0.5 in., and the stiffness in heave 450 lb/in. The stiffness in pitch and roll is a function of the skirt design, the values for finger skirts being about one third of those for bag skirts. The stiffness in roll is about half that in pitch. Petrol engines with maximum outputs of around 10 hp are used to provide cushion air, but direct drive systems usually absorb much less than this maximum.
Author (ESRO)

N74-20675# European Space Research Organization, Paris (France).
DETERMINATION OF THE DERIVATIVES OF LONGITUDINAL MOTION OF AN AIRCRAFT FROM FLIGHT DATA BY A MODEL WITH AUTOMATIC PARAMETER ADJUSTMENT
R. Koehler Jan. 1974 44 p refs Transl. into ENGLISH of Bestimmung von Derivativen der Laengsbewegung eines Flugzeugs aus Flugmessdaten durch ein Modell mit Autom. Parametereinstellung, DLR-FB-73-13, DFVLR, Nov. 1972
(ESRO-TT-8; DLR-FB-73-13) Avail: NTIS HC $5.25; DEVLR Porz-Wahn: 10 DM

A circuit was used to determine the aircraft derivatives from flight data; this circuit needs relatively few computation elements from the analog computer. Since quadratic terms are used, the polar data can be determined from environment coefficients of a point.
Author (ESRO)

N74-20676# Joint Technical Coordinating Group for Air Launched Non-Nuclear Ordnance.
AIRCRAFT/STORES COMPATIBILITY SYMPOSIUM PROCEEDINGS, VOLUME 2
20 Sep. 1973 249 p refs Conf. held at Sacramento, Calif., 18-20 Sep. 1973 3 Vol.
(AD-773814; JTCG/ALNNO-WP-12-2-Vol-2) Avail: NTIS CSCL 01/3

Contents: Self-compensating store ejection; Naval missile

center photo data analysis of store-separation films; Low speed wind tunnel testing techniques to predict S-3A aircraft store drop and jettison characteristics; Extensions to the method for prediction of six-degree-of-freedom store separation trajectories at speeds up to the critical speed, including interactive graphics application and bodies of arbitrary cross section; Computer generated visual documentation of theoretical store separation analyses; A pivot mechanism to provide an extended jettison envelope for the F-15 aircraft. GRA

N74-20677# Mississippi State Univ., State College. Dept. of Aerophysics and Aerospace Engineering.
AN INVESTIGATION OF THE TRAILING VORTICITY BEHIND A STOL AIRCRAFT Final Report, Sep. 1971 - Aug. 1973
Lawrence J. Mertaugh and Rustom B. Damania Dec. 1973 109 p refs
(Contract F33615-72-C-1052; AF Proj. 1366)
(AD-774571; AASE-73-107; AFFDL-TR-73-138) Avail: NTIS CSCL 01/1

The report presents the results of a test program to measure the near-field wake behind the wing of a test aircraft, out of the ground effect, and to obtain vortex trajectory data on trailing vortices generated within the ground effect. The test aircraft was a high-lift L-19 aircraft incorporating a distributed-suction boundary layer control system. The wake measurement probe was supported from the fuselage of the test aircraft and was mounted on a trolley which moved along a boom structure. The velocity measurements were made with a six-element hot-film anemometer. The near field wake data were obtained in two measurement planes located 0.64 and 5.10 feet behind the wing. Data were obtained at zero and fullflap deflection and true speeds of 46, 66, and 85 mph. The data are presented as contours of constant normalized vorticity, nondimensional vertical velocity, and non-dimensional longitudinal velocity increment within the measurement planes. (Modified author abstract) GRA

N74-20678# Calspan Corp., Buffalo, N.Y.
FLIGHT INVESTIGATION OF LATERAL-DIRECTIONAL FLYING QUALITIES AND CONTROL POWER REQUIREMENTS FOR STOL LANDING APPROACH USING THE X-22A AIRCRAFT. VOLUME 1: TECHNICAL RESULTS Final Report
R. E. Smith, J. V. Lebacqz, and R. C. Radford Feb. 1974 117 p refs
(Contract N00019-72-C-0417)
(AD-774728; CALSPAN-AK-5130-F-1-Vol-1) Avail: NTIS CSCL 01/2

A flight investigation of the influence of lateral-directional dynamics and control power requirements on flying qualities for STOL aircraft in terminal area operations was conducted using the X-22A variable stability aircraft. The primary dynamic variables of the experiment were roll mode time constant, Dutch roll undamped natural frequency, roll-to-sideslip ratio, and yaw due to aileron; in addition, the roll control power available was varied by electrically limiting the lateral stick command of the evaluation pilot. Three pilots performed 102 evaluations of various combinations of these variables at a representative STOL approach condition of gamma = -7.5 degrees, V = 65 kts. During the evaluations, a qualitative separation of ambient turbulence level was made through approximate measurements from the aircraft. (Modified author abstract) GRA

N74-20679# Calspan Corp., Buffalo, N.Y.
FLIGHT INVESTIGATION OF LATERAL-DIRECTIONAL FLYING QUALITIES AND CONTROL POWER REQUIREMENTS FOR STOL LANDING APPROACH USING THE X-22A AIRCRAFT. VOLUME 2: BACKGROUND INFORMATION Final Report
R. E. Smith, J. V. Lebacqz, and R. C. Radford Feb. 1974 314 p refs
(Contract N00019-72-C-0417)
(AD-774729; CALSPAN-AK-5130-F-1-Vol-2) Avail: NTIS CSCL 01/2

For abstract, see N74-20678.

N74-20680# Calspan Corp., Buffalo, N.Y.
A FIXED-BASE GROUND SIMULATOR STUDY OF CONTROL AND DISPLAY REQUIREMENTS FOR VTOL INSTRUMENT LANDINGS WITH A DECELERATING APPROACH TO A HOVER Final Report
Edwin W. Aiken and John M. Schuler Feb. 1974 97 p refs
(Contract N00019-72-C-0380)
(AD-774750; CALSPAN-AK-5113-F-2) Avail: NTIS CSCL 01/2

An exploratory study of the control and display requirements for performing decelerating transition landings on instruments with the X-22A aircraft was conducted utilizing the X-22A fixed-base ground simulator as a test bed. This experiment was prerequisite for an in-flight VTOL Transition Landing Program using the variable stability X-22A as a research vehicle. Both full and partial transitions to a hover were flown along a 10 degrees glide path at deceleration levels of up to 0.1 g. Various control/display system combinations were designed, developed, and evaluated for the task. Two specific objectives of the experiment were to investigate the benefits of a direct velocity control system, as opposed to the normal X-22A thrust controls, and to determine the feasibility of adapting, through electronic rather than mechanical means, the X-22A duct rotation system to direct velocity control. (Modified author abstract) GRA

N74-20681# RAND Corp., Santa Monica, Calif.
A DASSAULT DOSSIER: AIRCRAFT ACQUISITION IN FRANCE
Robert Perry Sep. 1973 42 p refs Sponsored by AF
(AD-774598; R-1148-PR) Avail: NTIS CSCL 01/3

The report is concerned with Avions Marcel Dassault-Breguet, generally held to be one of the most efficient aircraft development and production firms in the western world. Its purpose is to examine and evaluate the policies, strategies, operating practices, and external relationships that appear to be responsible for that reputation and for the achievements that underlie it. A principal object of the study is to identify those Dassault attributes that might beneficially be adapted to an American setting and to estimate the feasibility of so doing. GRA

N74-20682# Albuquerque Univ., N.Mex.
FALCONRY AS A MEANS OF REDUCING BIRD-AIRCRAFT STRIKE HAZARDS AT WHITEMAN AIR FORCE BASE, MISSOURI Final Report, 15 Sep. 1972 - 22 Apr. 1973
Edwin Mattingly Jan. 1974 40 p refs
(Contract F29601-73-C-0100; AF Proj. 683L)
(AD-774568; AFWL-TR-73-175) Avail: NTIS CSCL 01/2

A serious bird-aircraft strike hazard exists at Whiteman AFB (WAFB), Mo., because of the resident flock of protected Greater Prairie Chickens (Tympanuchus cupido pinnatus) which may be found on and near the runways. In recent years an increasing traffic load, involving mostly jet aircraft, frequently with highly sensitive cargo, has raised the strike hazard to intolerable limits. During the last 5 years, a minimum of 12 bird/aircraft strikes were recorded each spring. After almost all conventional methods of bird control has been tried with only partial or temporary success, a program of continual harrassment using combinations of men, dogs, and falconry proved the most effective in the spring of 1973. Two air strikes were experienced early in the test program and none after that. By techniques described herein, the strike hazard at WAFB was reduced by at least 83.3%. Author (GRA)

N74-20683# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AIR CUSHION LANDING SYSTEM PERFORMANCE ON A TENTH-SCALE MODEL JINDIVIK RPV M.S. Thesis
Philip M. Parker, Jr. Nov. 1973 74 p refs
(AD-774389; GAM/AE/73A-15) Avail: NTIS CSCL 01/3

Tests were conducted on an air cushion landing system ACLS installed on a tenth-scale model Jindivik RPV. The model has the correct Froude-scaled values of weight, center of gravity cg and moment of inertia about all three axes. The results of these tests were compared to the results of similar tests conducted on the ACLS of a full-scale model Jindivik. Static tests on the tenth-scale ACLS determined the heave stiffness to be 11 lb per in., the pitch stiffness to be .155 lb ft per deg (for a nose down moment) and the roll stiffness to be .0048 lb ft per deg. These values were within 60% of the full-scale values. Drop

tests showed the maximum load at the cg of the model to vary between 2.2 g's at the scaled nominal landing rate of descent, to 5.4 g's at the maximum landing rate of descent. (Modified author abstract) GRA

N74-20684# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN EXPERIMENTAL STUDY OF THE EFFECT OF A LOW SPEED EXTERNAL FLOW ON A COANDA EFFECT FLAP M.S. Thesis
Henry G. Hamby, III Dec. 1973 65 p refs
(AD-774393; GAM/AE/73A-9) Avail: NTIS CSCL 01/3

An experimental study of the effect of a low speed air flow external to the blowing flow over a coanda effect flap was conducted. The test model had a 122 ft/sec external flow over an airfoil surface which terminated with a coanda effect flap. The flap had an internal flow velocity of 452 ft/sec at the coanda nozzle exit. The model was equipped to make possible vertical force measurements and schlieren photography of the flap area. The force measurements showed that the net vertical force produced by the combined internal and external flows was equal to the net vertical force of the individual flows. (Modified author abstract) GRA

N74-20685# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN EXPERIMENTALLY BASED PREDICTION OF THE STATIC PERFORMANCE IN THE VERTICAL DIRECTION OF AN AIR CUSHION LANDING SYSTEM M.S. Thesis
John L. Stuart Dec. 1973 56 p refs
(AD-774387; GAM/AE/73A-17) Avail: NTIS CSCL 01/3

The purpose of the study was to develop an analytical procedure which can be used to predict the static performance of an Air Cushion Landing System in the vertical direction. A mathematical model of an ACLS was developed which interrelates the system variables used to describe the force balance, the flow balance, and the geometric constraints which exist in the static mode. Since the mathematical model yielded only nine equations in thirteen unknowns, four additional equations were generated from experimental data taken from scale models of an ACLS-equipped CC-115 aircraft. Experimental values of trunk pressure, cushion pressure, and ground clearance at different gross weights for both floor-in and floor-out conditions are required as inputs to the prediction procedure. (Modified author abstract) GRA

N74-20686# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
STATIC TWO DIMENSIONAL PERFORMANCE OF A CUSHION FED AIR CUSHION LANDING SYSTEM M.S. Thesis
Eduardo M. Carreras Dec. 1973 76 p refs
(AD-774394; GAW/AE/74-1) Avail: NTIS CSCL 01/3

Tests were conducted on a two dimensional model of the trunk region of an air cushion landing system to determine the performance under different flow conditions. The purpose of these tests was to evaluate the effect of the trunk to cushion flow ratio, the cushion to trunk pressure ratio, the flow injection angle and the ratio of the escape area to the nozzle area. Performance was characterized by the ratio of the horsepower required to the horsepower required by an ideal plenum air cushion device under the same conditions. (Modified author abstract) GRA

N74-20687# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
BALLOON APEX PRESSURE DIFFERENTIAL. (A SIMPLE APPROXIMATION OF PRESSURE DIFFERENTIAL AT THE APEX OF SINGLE CELL, NATURAL SHAPE BALLOONS) Interim Report
James F. Dwyer 9 Oct. 1973 12 p refs
(AD-774399; AFCRL-IP-202; AFCRL-TR-73-0632) Avail: NTIS CSCL 01/3

A simple approximation of the apex pressure differential is derived for single cell, natural shape balloons. For most present day balloons the approximation is valid up to at least tropopause heights. Use of the equation $p = 0.93b2/3Wg1/3$ (accurate to within 5 per cent) should provide an easy method for both designers and operators. Author (GRA)

N74-20688# Calspan Corp., Buffalo, N.Y.
A REVIEW OF THE X-22A VARIABLE STABILITY AIRCRAFT AND RESEARCH FACILITY Final Report
J. Victor Labacoz, Rogers E. Smith, and Robert C. Radford Feb. 1974 98 p refs
(Contract N00019-72-C-0417)
(AD-774142; CALSPAN-AK-5130-F-2) Avail: NTIS CSCL 01/3

The variable stability X-22A aircraft and associated research facilities represent a unique capability to perform V/STOL flying qualities research. The demonstrated fix-operating point capabilities of the aircraft's variable stability system are reviewed, and the recent extension of these capabilities for hover and transition is documented in detail. The report also contains summary descriptions of the ground simulator facility, the X-22A aircraft systems, and data processing and analysis procedures. Author (GRA)

N74-20689# United Aircraft Corp., Stratford, Conn. Sikorsky Aircraft Div.
A DESIGN ANALYSIS OF CH-54B MAIN ROTOR HUB FABRICATED FROM COMPOSITE MATERIALS Final Technical Report
Robert Lee Faiz Oct. 1973 228 p refs
(Contract DAAJ02-72-C-0104; DA Proj. 1F1-62208-A-170)
(AD-774270; SER-50827; USAAMRDL-TR-73-49) Avail: NTIS CSCL 01/3

A design and structural analysis of a CH-54B main rotor hub fabricated from composite materials was made to assess the flightworthiness of a hub consisting basically of tension straps fabricated from graphite epoxy and fiberglass. The concept is feasible but not competitive with the production titanium hub from a weight standpoint. Author (GRA)

N74-20690# Army Air Mobility Research and Development Lab., Fort Eustis, Va.
EFFECTS OF HELICOPTER EXTERNAL LOADS ON SLING PROPERTIES Final Report
Arthur J. Gustafson, Jr., Max E. Bryan, Edgar H. McIlwean, and Eugene A. Birocco Sep. 1973 85 p refs
(DA Proj. 1F1-62203-A-435)
(AD-774267; USAAMRDL-TR-73-91) Avail: NTIS CSCL 01/3

Samples of webbing of the type currently used for slings to carry external cargo by Army helicopters were tested to determine which environmental factors contributed to premature failure of the webbing. The environmental factors included outdoor exposure, temperature, humidity, JP-4 and seawater immersion, sand, and vibratory loading. Several types of nylon and Dacron were tested. The results of these tests indicate that outdoor exposure has a major effect on webbing strength. The presence of sand between the yarns in the webbing produces early failure. Shackle FSN 1670-090-5354 causes severe damage to slings under vibratory loading if used without a protective pad. Temperature, humidity, fuel and seawater immersion, and indoor storage have a negligible effect on webbing strength. Author (GRA)

N74-20691# Bell Aerospace Co., Buffalo, N.Y.
JET NOISE REDUCTION TECHNIQUE FOR MILITARY RECONNAISSANCE/SURVEILLANCE AIRCRAFT. PHASE 1: BENCH/WIND TUNNEL TESTS Final Report, 30 Jun. 1971 - 31 Jul. 1972
F. B. Bossler, M. V. Barsottelli, and V. Krishnamoorthy Aug. 1973 150 p refs
(Contract F33615-71-C-1840; AF Proj 1471)
(AD-774748; BAC-7389-945009; AFFDL-TR-72-107) Avail: NTIS CSCL 01/3

A novel method of jet noise reduction has been subjected to bench and wind tunnel tests. This method uses very small nozzles arranged on struts protruding from the upper surface of an aircraft wing. These nozzles are intended to replace the conventional single propulsive nozzle of the jet engine for the primary purpose of reducing the aural detectability of the jet noise by modifying its frequency spectrum. Tests of this concept

were conducted during this program including acoustic comparison of a dozen different nozzle arrangements; tests with heated air; acoustic and propulsion tests of an array of several thousand nozzles; acoustic wind tunnel tests of struts and inlet configurations; and aerodynamic wind tunnel tests of an array of 6,000 nozzles on a wing section. Additional tasks included preliminary design of a quiet research test vehicle and prediction of its aural detectability. Tests of various nozzle arrangements resulted in selection of a single row of nozzles on each strut. Tests with heated air showed that jet noise could be predicted based on jet velocity, independent of jet temperature. (Modified Author abstract) GRA

N74-20692# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
TEST PLAN FOR THE HOOK BOUNCE CONDITION OF THE E-2A AIRPLANE ARRESTING GEAR A FRAME Test Plan Report
Robert B. Cadman 30 Nov. 1973 8 p refs Revised
(AD-774084; NADC-72216-VT-Rev-A) Avail: NTIS CSCL 01/5

The E-2A arresting hook A-frame is currently adequate for 500 arrested landings. It is the purpose of this effort to extend the life to 3,000 arrested landings for the hook bounce condition. Author (GRA)

N74-20693# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
TEST PLAN FOR THE HOOK BOUNCE CONDITION OF THE C-2A AIRPLANE ARRESTING GEAR A FRAME Test Plan Report
1 May 1973 10 p refs Revised
(AD-774083; NADC-72178-VT-Rev-A) Avail: NTIS CSCL 01/5

The C-2A arresting hook A-frame is currently adequate for 500 arrested landings. It is the purpose of this effort to extend the life to 3000 arrested landings for the hook bounce condition. Author (GRA)

N74-20694# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ADDITION OF AN ARBITRARY BODY ANALYSIS CAPABILITY TO THE BOEING TEA 236 FINITE ELEMENT COMPUTER PROGRAM M.S. Thesis
James L. Westphal Dec. 1973 91 p refs
(AD-774430; GAM/AE/73A-20) Avail: NTIS CSCL 01/3

The Boeing TEA 236 computer program, used to calculate wing pressure distributions of wing-body configurations, is examined. Small perturbation potential theory, as used by the program, is reviewed. The method used by the TEA 236 in the analysis of a fuselage of circular cross-section, in calculating wing pressures, is examined. The capability to analyze an arbitrary body cross-section is added by employing at least-squares fitted cosine series to more accurately describe the actual body cross-section. Comparison is made between C-5A wind tunnel data, computed data obtained from the TEA 236 using its unmodified circular body routine, and computed data obtained from the TEA 236 using the analytical body description technique developed in this study. (Modified author abstract) GRA

N74-20695# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AIR CUSHION LANDING SYSTEM DROP DYNAMICS THEORY (MECHANICAL) M.S. Thesis
Frederick C. Bauer Dec. 1973 103 p refs
(AD-774431; GAM/AE/73A-1) Avail: NTIS CSCL 01/2

A mechanical analog Vertical Energy Absorption Model (VEAM) is developed to predict the dynamics of an Air Cushion Landing System (ACLS) in the vertical dimension. Three degrees of freedom and thus three primary modes of oscillation are investigated: heave, pitch and roll. Data from Air Force Flight Dynamics Laboratory Tests of a full-scale Australian Jindivik drone are used to develop and verify the model. The VEAM study demonstrates that the use of a mechanical analog prediction scheme for an Air-Cushion Landing System has sufficient merit to warrant further investigation. It shows that a mechanical analog model can predict system response within the model domain of three degrees of freedom without knowledge of the numerous and varying trunk and cushion parameters if the mode spring and damper coefficients are provided. (Modified author abstract) GRA

N74-20696# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN ANALYSIS OF THE LONGITUDINAL DYNAMICS OF A STOL TRANSPORT IN LANDING APPROACH M.S. Thesis
Glen M. Personius Dec. 1973 83 p refs
(AD-774434; GAM/MC/73A-1) Avail: NTIS CSCL 01/2

The longitudinal dynamic response of representative STOL transport in landing approach was analyzed and the results compared with existing military handling qualities specifications. Eigenvalues and eigenvectors for the basic airplane were calculated using EISPACK subroutines for the CDC-6600 computer. Time histories of response were obtained by using series expansion techniques to solve the state equations. The parameter, Mu, change in pitching moment with change in forward speed, was found to have a powerful effect on both static and dynamic stability. Low short period frequency and negative phugoid damping in the landing approach speed range, combined with strong coupling between flight path and airspeed, make the basic airplane longitudinal dynamics unacceptable. Some suggestions are made relative to the preliminary design of a stability augmentation system for this airplane. Author (GRA)

N74-20771 Army Aeromedical Research Lab., Fort Rucker, Ala.
ARMY AUTOROTATIONAL ACCIDENTS
Kent A. Kimball, Donald F. Harden, and Mark A. Hofmann *In* AGARD Escape Probl. and Manoeuvres in Combat aircraft Feb. 1974 10 p (For availability see N74-20756 12-05)

N74-21614 National Aerospace Lab., Amsterdam (Netherlands).
TECHNICAL AND OPERATIONAL ASPECTS OF EXTERNALLY-MOUNTED AIRCRAFT EQUIPMENT
T. VanOosterom *In* AGARD AGARD Ann. Meeting, 1973 Dec. 1973 p 29-34 (For availability see N74-21610 12-34)

N74-21615 Ministry of Defence, London (England).
THE REDUCTION OF AIRFRAME COSTS WITH PARTICULAR REFERENCE TO COMBAT AIRCRAFT
J. Seddon *In* AGARD AGARD Ann. Meeting, 1973 Dec. 1973 p 34-39 (For availability see N74-21610 12-34)

N74-21616 Ministry of Defence (West Germany).
THE HINGELESS ROTOR: A CONCEPT TO INCREASE MISSION EFFECTIVENESS AT REDUCED COSTS
R. Barth *In* AGARD AGARD Ann. Meeting, 1973 Dec. 1973 p 40-50 refs (For availability see N74-21610 12-34)

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines, hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; Nuclear Engineering; and 28 Propulsion Systems.

N74-20697 Kansas State Univ., Manhattan.
OPTIMAL ELECTRICAL ENERGY GROWTH STRATEGIES IN AN ERA OF ENVIRONMENTAL CONCERN Ph.D. Thesis
Jerry William Stauder 1973 151 p
Avail: Univ. Microfilms Order No. 74-6661

A linear programming model of the United States' expanding electrical energy economy is presented. The model finds the minimum cost compromise among the three problems of rapid growth of electrical energy demand, a marginal fuel supply, and environmental protection. It was assumed that the electrical energy demand would be met primarily with nuclear and coal fueled power plants. Linear programming was selected as the optimizing tool. The objective was to minimize the total cost of generating the electrical energy demand in the time period of 1970 to 2000. The costs considered are capital, fuel, operating and

maintenance, storage costs of certain fuels, and costs associated with environmental protection. Dissert. Abstr.

N74-20698*# General Electric Co., Cincinnati, Ohio.
SNAP-8 REFRACTORY BOILER DEVELOPMENT PROGRAM Final Report
R. A. Fuller Washington NASA Apr. 1974 230 p
(Contract NAS3-10610)
(NASA-CR-2372) Avail: NTIS HC $6.00 CSCL 10A

Performance and endurance tests of the SNAP-8, SN-1 refractory metal boiler are described. The tests were successful and indicated that the boiler heat transfer area could be reduced significantly primarily because of the wetting characteristics of mercury on tantalum in a contaminant-free environment. A continuous endurance test of more than 10,000 hours was conducted without noticeable change in the thermal performance of the boiler. A conclusion of the metallographic examination of the boiler following the endurance test was that expected boiler life would be of the order of 40,000 hours at observed corrosion rates. Author

N74-20699# Stanford Research Inst., Menlo Park, Calif.
PATTERNS OF ENERGY CONSUMPTION IN THE UNITED STATES
Jan. 1972 236 p refs Sponsored by Office of Sci. and Technol.
Avail: SOD HC $2.25

The objectives of the study are to determine: (1) what significant purposes have fuels been used for in the United States; (2) what portion of the nation's energy requirements for the various end uses have been met by each fuel; (3) what has been the rate of growth of consumption in the major end uses of each fuel; (4) what technical efficiency can be expected when each fuel is used for those end uses for which it is suitable; The emphasis of the study was on the residential, commercial, and industrial sectors, the use of electric power has also been incorporated, along with the transportation sector, in order to arrive at a total energy balance. This report is strictly a factual document; its purpose is to provide the most detailed information practicable on how the nation uses its energy. Author

N74-20700*# Kanner (Leo) Associates, Redwood City, Calif.
SUPPLEMENT TO THE REPORT ON THE RESULTS ACHIEVED WITH SEAS' EXPERIMENTAL MILL
J. Juul Washington NASA Apr. 1974 40 p refs Transl. into ENGLISH from Elektroteknikeren (Copenhagen), v. 48, Feb. 1952 p 65-79
(Contract NASw-2481)
(NASA-TT-F-15516) Avail: NTIS HC $5.00 CSCL 10A

Results achieved with an experimental windmill are elaborated on: greatest efficiency of the mill was obtained at a wingtip velocity of 38 m/x; effects caused by wind pressure should not exceed 800 kg/sq cm in any part of the wing or tower, and effects caused by gravity in the wings should not exceed 200-300 kg/sq cm. Experience has shown that the optimal height of the support tower should be from 18-24 m. A history of the Dutch windmill's use and its construction, and also of various modern experimental wind power stations in various parts of the world is given. Costs of building wind power stations are discussed. Author

N74-20701*# Techtran Corp., Glen Burnie, Md.
LINES OF DEVELOPMENT OF RURAL WIND POWER PLANTS
K. I. Shenfer and A. A. Ivanov Washington NASA May 1974 7 p refs Transl. into ENGLISH from Elektrichestvo (USSR), no. 5, May 1941 p 21-22
(Contract NASw-2485)
(NASA-TT-F-15513) Avail: NTIS HC $4.00 CSCL 10A

The use of wind power plants for rural electrification is discussed. The application of various alternative power supply systems involving wind power plants is examined, and the advantages and disadvantages of each alternative are presented. Author

N74-20702# Stuttgart Univ. (West Germany). Inst. fuer Plasmaforschung.
GENERAL ENERGY CONVERSION AND THE ENERGY MINIMUM PRINCIPLE [ALLGEMEINE ENERGIEWANDLUNG UND DAS ENERGIE-MINIMUMPRINZIP]
H. K. Messerle 1973 28 p refs In GERMAN
(IPF-73-4) Avail: NTIS HC $4.50

The internal or stored energy of an open system was used as a basis for the description of a general energy conversion theory. The properties of the energy function as a state function were determined by 4 postulates of which 3 were basic and intuitive. This results in defining the entropy as an intensive quantity with a reversible property. The energy losses which lead to entropy increase in the interior should be treated independently. So-called inverse processes can be treated as equalization of flow conditions. The result is a dynamic system representation in which the methodology of system theory is used. ESRO

N74-20703# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STATE-OF-THE-ART AND PROSPECTS OF MAGNETOELECTRIC MACHINES FOR SELF-CONTAINED ELECTRICAL SUPPLY SYSTEMS AND CONTROLLABLE ELECTRICAL DRIVERS
V. A. Balagurov and N. T. Koroban 14 Jan. 1974 20 p refs Transl. into ENGLISH from Tr. Energ. Inst. (Moscow), no. 139, 1972 p 6-18
(AD-773893; FTD-HT-23-26-74) Avail: NTIS CSCL 10/2

The characterisitics and applications of magnetoelectric machines are discussed. The development of improved permanent magnets for use with magnetoelectric machines has made it possible to broaden the field of application of the machines with respect to power and frequency. The specific characteristics of the permament magnets for various applications are defined. It is stated that the selection of one type of magnet system and magnetoelectric generator design over another is usually determined by the magnetic and technological properties of the alloys and the purpose, power, speed, and frequency of the generator. Author

N74-20704# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DEPENDENCE OF EFFICIENCY AND SPECIFIC CHARACTERISTICS OF FUEL CELLS ON DISCHARGE CONDITIONS
V. S. Daniel-Bek 8 Jan. 1974 17 p refs Transl. into ENGLISH from Sb. Rab. Khim. Istochnikam Toka (Leningrad), no. 2, 1967 p 155-163
(AD-773264; FTD-HT-23-8-74) Avail: NTIS CSCL 10/2

An analysis is given of the dependence of efficiency, specific power, and specific energy of a fuel cell on the discharge conditions. General principles for selecting optimum conditions are examined. GRA

N74-20705# Defense Documentation Center, Alexandria, Va.
ENERGY SOURCES - CITATIONS FROM THE EARLY DDC COLLECTIONS Report Bibliography, Mar. 1933 - Jun. 1952
Jan. 1974 25 p refs
(AD-773325; DDC-TAS-74-10) Avail: NTIS CSCL 21/4

This bibliography consists of 121 citations on Energy Sources dated March 1933 to June 1952. These are not in the collection of the DDC Automated Data Banks. They are arranged by ATI (Air Technical Index) numbers, and are available via regular DDC document request procedures. GRA

N74-20706# Boeing Co., Seattle, Wash.
REAL-TIME SPACE AND NUCLEAR EFFECTS ON SOLAR CELLS (ACCELERATED EVALUATION METHODS) Interim Technical Report, 17 May 1972 - 17 May 1973
William E. Horne and Barbara K. Madaras Oct. 1973 113 p refs
(Contract F33615-71-C-1583; AF Proj. 3145)
(AD-774592; D180-10491-3; AFAPL-TR-72-69-Vol-2; ITR-2) Avail: NTIS CSCL 10/2

The report discusses exploratory testing and data analyses. A proposed model for the annealing of lithium solar cells is presented. In addition, new data showing the energy dependence of proton and electron damage in lithium-doped silicon and the annealing of such damage are presented. New data also indicate that simultaneous irradiations with protons and electrons produce

synergistic effects. These effects may produce either more or less damage than the sum of the separate environment depending on the relative electron-to-proton fluences. (Modified author abstract) GRA

N74-20707# Aerospace Corp., El Segundo, Calif. Lab. Operations.
PENETRATION OF CADMIUM INTO NYLON SEPARATORS OF Ni-Cd BATTERIES
Stanley W. Mayer and David Taylor 2 Jan. 1974 23 p refs (Contract F04701-73-C-0074)
(AD-774562; TR-0074(4270-10)-3; SAMSO-TR-74-17) Avail: NTIS CSCL 10/3

Because of the preflight occurrence of failure resulting from a short circuit between plates and extensive cadmium migration to the separators of a Ni-Cd cell intended for long-term use in a satellite, a series of photomicrographic investigations has been made of the depth of cadmium penetration into a separator from the cell and related cells. Electron probe and ion probe studies were also conducted. It was found that cadmium penetrations as deep as 80% occurred, and, in many instances, a depth of more than 30% of separator penetration was observed. Since cell failure and battery performance losses can be caused by 100% penetration depths of cadmium, the results of the investigation indicate that cadmium migration and penetration into the separators of this set of Ni-Cd cells constitute a serious problem with respect to meeting the power-storage lifetime requirements of the electrical system for the satellite.
Author (GRA)

N74-20708# TRW Systems Group, Redondo Beach, Calif.
INVESTIGATION OF HIGH TEMPERATURE BATTERY SYSTEMS Final Technical Report, 1 Jul. 1972 - 31 Oct. 1973
E. T. Seo, R. R. Sayano, D. F. Carroll, M. L. Mclanahan, and H. P. Silverman Jan. 1974 46 p
(Contract DAAB07-72-C-0312)
(AD-774308; TRW-23323-6015-RU-00; ECOM-0312-F) Avail: NTIS CSCL 10/3

The main objective of this program was the construction and testing of sodium-sulfur cells which would be hermetically sealed and operable at 300C. Intermediate objectives included the evaluation of all proposed materials, seals and construction techniques as to their suitability for the sodium-sulfur system. New sealing methods for making ceramic to metal seals were developed. (Modified author abstract) GRA

N74-20709# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
DESIGN CONSIDERATIONS FOR A 100-MEGAJOULE/500-MEGAWATT SUPERFLYWHEEL
David W. Rabenhorst and Robert J. Taylor Dec. 1973 87 p refs
(Contract N00017-72-C-4401)
(AD-774736; APL-TG-1229) Avail: NTIS CSCL 10/1

The magnitude of stored energy required in high power bursts for modern experiments in physics has reached the point where capacitor banks previously used for this purpose are no longer practical. Although flywheels have been proven to be less expensive for this purpose and are one-hundredth the size, even the practicality of future flywheel-powered systems is being challenged by the magnitude of future experiment energy requirements. An existing steel flywheel capable of delivering 100 MJ at a rate of 100 MW costs $1,500,000 and weighs 60,000 pounds. Future experiments may require 20 times this energy. The report describes a Superflywheel having a design goal of delivering 100 MJ at a rate of 500 MW. Its projected cost is less than $50,000. Also, it appears to be readily scalable to the larger size required for future experiments. Author (GRA)

N74-20710# Pratt and Whitney Aircraft, East Hartford, Conn.
THE 1.5-kW FUEL CELL POWERPLANT CATALYST INVESTIGATION Supplement to Final Report, 1 Oct. 1972 - 30 Jun. 1973
Donald R. McVay Jul. 1973 29 p
(Contract DAAK02-70-C-0518; DA Proj. 1G6-63702-DG-10)
(AD-774274; PWA-4704A-Suppl) Avail: NTIS CSCL 10/2

The objective of this program was to improve the PC14 powerplant thermal cracker catalyst and to define its performance characteristics. Five areas were investigated: (1) the type of catalyst ceramic support and the level of nickel loading, (2) the effect of shock and vibration on performance, (3) performance on leaded gasoline and JP-4, (4) the effect of high sulfur fuel on performance, and (5) endurance on leaded gasoline. The results of the study are given in the report. GRA

N74-20763 Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
OPERATIONAL PRACTICALITY OF FLY AWAY EJECTION SEATS
R. Harley Walker, Jr. *In* AGARD Escape Probl. and Manoeuvres in Combat Aircraft Feb. 1974 15 p refs (For availability see N74-20756 12-05)

N74-20766 Naval Air Development Center, Warminster, Pa. Crew Systems Dept.
ADVANCED CONCEPTS FOR ROTARY WING AND V/STOL AIRCRAFT ESCAPE SYSTEMS
William G. Law *In* AGARD Escape Probl. and Manoeuvres in Combat Aircraft Feb. 1974 5 p refs (For availability see N74-20756 12-05)

N74-20770 Institut fuer Flugmechanik, Brunswick (West Germany).
ESCAPE MEASURES FOR COMBAT HELICOPTER CREWS
H. D. Melzig and U. Schmidt *In* AGARD Escape Probl. and Manoeuvres in Combat Aircraft Feb. 1974 11 p refs (For availability see N74-20756 12-05)

N74-20772 Naval Air Development Center, Warminster, Pa.
IN-FLIGHT ESCAPE SYSTEM FOR HEAVY HELICOPTERS
William Ogden and Gary Davis (Naval Air Systems Command) *In* AGARD Escape Probl. and Manoeuvres in Combat Aircraft Feb. 1974 9 p refs (For availability see N74-20756 12-05)

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N74-20711*# University City Science Center, Philadelphia, Pa.
RESEARCH ON THE EFFECTS OF ALTERED GRAVITY AND OTHER FACTORS ON THE GROWTH AND DEVELOPMENT OF HIGHER PLANTS Final Technical Report
A. H. Brown 21 Nov. 1973 13 p
(Contract NASw-2208)
(NASA-CR-137420) Avail: NTIS HC $4.00 CSCL 06C

The establishment, maintenance and use of the NASA-UCSC Botanical Centrifuge is discussed. The broad goals of this project were: (1) to establish facilities for conducting experiments under conditions of sustained centrifugation; (2) to pursue research on the gravitational physiology of higher plants; (3) to develop experimental hardware suitable for studies of plant development in the weightless condition; and (4) to accomodate visiting investigators whose researches are of interest to the NASA Biomedical Program and who may require for some limited time, the use of a medium size centrifuge with associated facilities appropriate for plant physiological studies. Author

N74-20712*# Michigan Univ., Ann Arbor. Mental Health Research Inst.
SIMULATED WEIGHTLESSNESS IN FISH AND NEUROPHYSIOLOGICAL STUDIES ON MEMORY STORAGE Final Technical Report, 1 Jun. 1969 - 30 Jun. 1973
Rudolf J. VonBaumgarten Dec. 1973 16 p refs
(Grant NGR-23-005-201)
(NASA-CR-137419) Avail: NTIS HC $4.00 CSCL 06C

Simulated weightlessness was used to study the different types of gravity responses in blind fish. It was found that a shift in the direction of low magnitude acceleration in weightlessness causes a rapid 180 deg turn in the blind fish, while a shift in the direction of the applied acceleration in the earth's gravitational field is not significant because of a higher acceleration

magnitude threshold than during the zero g condition. This increased responsiveness seems to be explained by a combination of directional sensitivity with a Weber-Fechner relationship of increased receptor sensitivity at diminished levels of background stimulation. Neurophysical studies of the statocyst nerve of the gastropod Mollusc Pleurobranchaea Californica were undertaken in order to understand how complex otolith systems operate. Information storage was investigated on relatively simple neuronal networks in the mollusc Aplysia. Intracellular electrical stimulation of isolated neurons show that a manipulation of autoditonous rhymicity is possible. It was also found that glycolysis and oxidative phosphorylation are involved in inherent rhymicity of Aplysis neurons. S.K.W.

N74-20713*# Food and Drug Administration, Cincinnati, Ohio. Food Research Lab.

ECOLOGY AND THERMAL INACTIVATION OF MICROBES IN AND ON INTERPLANETARY SPACE VEHICLE COMPONENTS Quarterly Progress Reports, 1 Apr. - 30 Sep. 1973

J. E. Campbell, Antolin L. Reyes, A. J. Wehby, R. G. Crawford, J. C. Wimsatt, and J. T. Peeler Sep. 1973 75 p refs

(NASA Order W-13411)

(NASA-CR-136901; QPR-33; QPR-34) Avail: NTIS HC $6.75 CSCL 06M

The mechanism for thermal inactivation of bacterial spores under moist or dry heat was studied. Experimental conditions were established relating to spore loss of heat resistance and loss of optical density as a measure of the rate and extent of germination in spore suspensions. Events occurring during germination were correlated with phase darkening (refractility and non-refractility of spores), stainability characteristics of heat and non-heat treated spores, morphological characteristics, and studies on swelling of spores by an increase in packed cell volume. Author

N74-20714*# Pennsylvania State Univ., University Park. Dept. of Biophysics.

THE PHYSICS OF CELLULAR SYNTHESIS, GROWTH AND DIVISION Final Report

Ernest C. Pollard 21 Jan. 1974 9 p refs

(Grant NGR-39-009-008)

(NASA-CR-136896) Avail: NTIS HC $4.00 CSCL 06A

Three areas of research in NASA'S University Program are described. Primitive terrestrial living cells were studied as a guide to the kind of cells to look for in extraterrestrial life. Experiments in zero gravity conditions are described with emphasis upon effects on small organisms. The effects of ionizing radiation on cells are studied so that it will be possible to predict dosages which can be tolerated by humans with no permanent damage. Author

N74-20715*# Chicago Univ., Ill. Div. of Biological Sciences.

INVESTIGATIONS IN SPACE-RELATED MOLECULAR BIOLOGY Final Report

H. Fernandez-Moran and A. N. Pritzker 27 Mar. 1974 22 p refs Presented at 2d Duran-Reynals Intern. Symp. on Viral Replication and Cancer, Barcelona

(Contract NGL-14-001-012)

(NASA-CR-138075) Avail: NTIS HC $4.25 CSCL 06C

Improved instrumentation and preparation techniques for high resolution, high voltage cryo-electron microscopic and diffraction studies on terrestrial and extraterrestrial specimens are reported. Computer correlated ultrastructural and biochemical work on hydrated and dried cell membranes and related biological systems provided information on membrane organization, ice crystal formation and ordered water, RNA virus linked to cancer, lunar rock samples, and organometallic superconducting compounds. Apollo 11, 12, 14, and 15 specimens were analyzed. G.G.

N74-20716*# Denver Research Inst., Colo. Industrial Economics Div.

A CASE STUDY OF TECHNOLOGY TRANSFER: REHABILITATIVE ENGINEERING AT RANCHO LOS AMIGOS HOSPITAL

William Hildred Jun. 1973 25 p refs

(Contract NASw-2362)

(NASA-CR-138073) Avail: NTIS HC $4.25 CSCL 06P

The transfer of NASA technolgy to rehabilitative applications of artificial limbs is studied. Human factors engineering activities range from orthotic manipulators to tiny dc motors and transducers to detect and transmit voluntary control signals. It is found that bicarbon implant devices are suitable for medical equipment and artificial limbs because of their biological compatibility with human body fluids and tissues. G.G.

N74-20717*# Hawaii Univ., Honolulu. Dept. of Botany.

GROWTH AND DEVELOPMENT IN INERT NON-AQUEOUS LIQUIDS Semiannual Report

S. M. Siegel Jan. 1974 29 p

(Grant NGL-12-001-042)

(Paper-36) Avail: NTIS HC $4.50 CSCL 06C

A preview is presented of the survival and growth capabilities of higher plants in non-aqueous, inert liquids. The two media which were used are mineral (white) oil and fluorochemical inert liquid FC-75. Both liquids dissolve oxygen and carbon dioxide readily, but are insoluble in water. Consequently, plants submerged in these liquids are capable of gas exchange with the atmosphere, but possess a water impermeable coating the dimensions of which are determined by the size of the liquid holding container. In a sense, growing plants in a tank of mineral oil imparts on them a cuticle. Plants plus prescribed volumes of water were innoculated into mineral oil. Organisms with minimal water supplied could then be observed. Also, submersed plants covered with an oil slick were shown to be capable of growth in dessicating atmospheres. Author

N74-20718*# Bethune-Cookman Coll., Daytona Beach, Fla. Dept. of Science and Mathematics.

A STUDY OF LAGOONAL AND ESTUARINE PROCESSES AND ARTIFICIAL HABITATS IN THE AREA OF THE JOHN F. KENNEDY SPACE CENTER Annual Report, Sep. 1972 - Oct. 1973

Premsukh Poonai 8 Apr. 1974 31 p refs Original contains color illustrations

(Grant NGR-10-022-001)

(NASA-CR-137409; AR-1) Avail: NTIS HC $4.75 CSCL 06C

In order to study the influence of an artificial habitat of discarded automobile tires upon the biomass in and around it, three sites were selected in the Banana River, one of which will serve as a control and the other two as locations for small tire reefs. Measurements and correlation studies of the biomasses and the species indicate that the biodynamics of the sites are appreciably the same in the three cases, that there are probably adequate populations at the lower trophic levels, that there are perhaps reduced numbers of upper level carnivores, and that it is likely that small artificial havens can contribute to an increase in populations of certain species of gamefish. Author

N74-20719*# Xavier Univ. of Louisiana, New Orleans. Dept. of Biology.

SOME CHARACTERISTICS OF FRUCTOSE 1,6-DIPHOSPHATASE ACTIVITY IN RAT LIVER

Portia U. Ashman, S. L. Lampkin, Lynette Dillon, and Rebecca Parks [1974] 30 p refs

(Grants NGR-19-007-004; RR-08008)

(NASA-CR-137415) Avail: NTIS HC $4.50 CSCL 06C

A reliable assay for hepatic fructose 1,6-diphosphatase in the rat was developed. It was found that the greatest enzymic activity and highest protein levels were eluted from the colored portion of the homogenate. When the substrate concentration was 0.01M, the enzyme had optimal activity when incubated with 0.01M $MgSO_4$ for 10 min. at 37 C in 0.05M Tris-HCl buffer, pH 7.5. Specificity for the substrate, fructose 1,6-diphosphate, was obtained at substrate concentration of 0.01M. Author

N74-20720# Advisory Group for Aerospace Research and Development, Paris (France).

AIRSICKNESS IN AIRCREW

T. G. Dobie (Leeds Univ.) Feb. 1974 75 p refs

(AGARD-AG-177; AGARDograph-177) Avail: NTIS HC $6.75

The problem of airsickness is examined in terms of loss of useful training time. Figures are presented which are likely to be typical of those which occur in any modern Air Force. Various methods of reducing this incidence are discussed, as well as an approach to the management of flying personnel with airsick-

ness. The signs and symptoms of airsickness are described. The aircraft maneuvers which are most likely to induce airsickness are analyzed. Author

N74-20721*# Techtran Corp., Glen Burnie, Md.
THE EFFECT OF HYPODYMANIA AND HYPOKINESIS ON THE ARTERIAL TREE OF THE PELVIC MUSCLES OF THE RABBIT'S EXTREMITIES
N. Ye. Sokolov Washington NASA May 1974 7 p refs Transl. into ENGLISH from Arkh. Anat. Gistol. Embriol. (USSR), v. 67, no. 4, Apr. 1972 p 48-52
(Contract NASw-2485)
(NASA-TT-F-15511) Avail: NTIS HC $4.00 CSCL 06C

Effects of hypodynamic conditions on the arterial bed in the muscles and adjacent structures of pelvic extremities in the rabbit were investigated. Anatomical methods of investigation revealed that hypodynamic conditions produced morphological transformations in intraorganic arterial system in the muscles, fascia and adipose cellular tissue of the immobilized extremity. These changes proved to be stable and retained during 6 months. Author

N74-20722*# Scientific Translation Service, Santa Barbara, Calif.
PROJECTIONS OF THE AMPULLARY CRISTAE OF THE UTRICLE IN THE PRIMARY CENTERS OF THE VESTIBULE. MICROPHYSIOLOGICAL STUDY AND ANATOMOFUNCTIONAL CORRELATIONS
Alain Sans, Jacqueline Raymond, and Robert Marty Washington NASA Apr. 1974 25 p refs Transl. into ENGLISH from Brain Res. (Amsterdam), no. 44, 1972 p 337-355
(Contract NASw-2483)
(NASA-TT-F-15521) Avail: NTIS HC $4.25 CSCL 06P

Electric stimulation using electric shocks of the different branches of the vestibular nerve is employed to determine the existence of vestibulotopia in the laterial medial and descending vestibular centers. The diameters of the vestibular nerve fibers were measured and the potentials were registered in order to establish anatomofunctional correlations. Author

N74-20723# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
ANALYSIS OF PHYSIOLOGICAL SYSTEMS BY PARAMETER ESTIMATION TECHNIQUES
J. A. Blom May 1973 40 p refs
(TH-73-E-36; ISBN-90-6144-036-X) Avail: NTIS HC $5.00

Parameter estimation techniques were used to analyze physiological systems, the ultimate goal being to predict a patient's reaction to drug administration quantitatively so that optimal therapy can be applied. Basic notions of physiological systems like state and optimal state are formalized. Both dynamic and nonlinear patient models are considered, and parameter estimation for these models are discussed. Dual control and automated intensive care are dealt with and simulation results are presented. ESRO

N74-20724# Wayne State Univ., Detroit, Mich. Biomechanics Research Center.
THE DYNAMIC RESPONSE OF THE SPINE DURING + Gz ACCELERATION Annual Report, 15 Mar. 1972 - 31 Jul. 1973
P. Prasad and A. I. King 30 Nov. 1973 257 p refs
(Contract N00014-69-A-0235-0001; NR Proj. 105-540)
(AD-772604) Avail: NTIS CSCL 06/19

The report reviews previous results and presents qualitative as well as quantitative experimental evidence of the existence of a dual load path in the human spine - one through the intervertebral disc and the other through the articular facets. A 78 degree-of-freedom mathematical model is proposed. Its results compare favorably with those from experimental measurements on three cadaveric spines subjected to Gz acceleration.
Author (GRA)

N74-20759 Naval Aerospace Medical Research Lab., New Orleans, La.
BIOENGINEERING ASPECTS OF SPINAL INJURY IN THE OV-1 (MOHAWK) AIRCRAFT
Channing L. Ewing and Daniel J. Thomas *In* AGARD Escape Probl. and Manoeuvres in Combat Aircraft Feb. 1974 9 p refs (For availability see N74-20756 12-05)

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N74-20725* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
REDUCED GRAVITY FECAL COLLECTOR SEAT AND URINAL Patent
Jeri Wexler Brown, inventor (to NASA) Issued 23 Apr. 1974 5 p Filed 15 Mar. 1973 Supersedes N73-20141 (11 - 11, p 1249)
(NASA-Case-MFS-22102-1; US-Patent-3,805,303;
US-Patent-Appl-SN-341621; US-Patent-Class-4-10;
US-Patent-Class-4-120) Avail: US Patent Office CSCL 06I

A waste collection system for use in a reduced gravity including a seat having an opening centrally located with a pair of opposed depressed valleys on opposite sides of said opening for accommodating the ischial tuberosities of a user. The seat has contoured surfaces for providing support of the user's body and includes a prominent ridge towards the rear, which provides forward-aft positioning cue to the user. A curved recess is provided adjacent the forward portion of the seat for accommodating a tubular urinal having an enlarged open mouth.
Official Gazette of the U.S. Patent Office

N74-20726* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ULTRASONIC BIOMEDICAL MEASURING AND RECORDING APPARATUS Patent
Robert D. Lee, inventor (to NASA) Issued 9 Apr. 1974 9 p Filed 18 Aug. 1972 Supersedes N72-31116 (10 - 22, p 2923)
(NASA-Case-ARC-10597-1; US-Patent-3,802,253;
US-Patent-Appl-SN-281876; US-Patent-Class-73-67.9;
US-Patent-Class-128-2V) Avail: US Patent Office CSCL 06B

A train of ultrasonic pulses is beamed into the body of an animal. Organs intercepted by the beam reflect echo pulses following each transmitted pulse. An electronic gate with a variable width and a variable time delay relative to the transmitted pulse is utilized for selecting echoes derived from other organs or portions of organs. The integral of the echo signals received within the first half of the gate period is subtracted from a corresponding integral of the echo signal received during the second half of the gate to derive an error signal for controlling the time delay of the gate. In this manner, the selected echo signal is always maintained in the center of the gate.
Official Gazette of the U.S. Patent Office

N74-20727 Illinois Univ., Urbana.
A PARAMETRIC STUDY OF PILOT PERFORMANCE WITH MODIFIED AIRCRAFT CONTROL DYNAMICS, VARYING NAVIGATIONAL TASK COMPLEXITY, AND INDUCED STRESS Ph.D. Thesis
Emmett Francis Kraus 1973 113 p
Avail: Univ. Microfilms Order No. 74-5614

Experiments were conducted in a Link GAT-2 to evaluate the effectiveness of a system providing direct control over aircraft maneuvering performance. Pilots performed complex navigational tasks involving the use of a computer-assisted area navigation system. Changing waypoint storage capacity of the simulated navigation system induced variable task loading on subjects. The experiment was replicated with and without a self-adaptive side task to determine levels of residual attention associated with the control modifications and the varying workload levels. The flight performance controller yielded greater precision of maneuvering control, fewer procedural blunders, and an increased level of residual pilot attention. The side task proved to be a relaible discriminator to changes in workload associated with small changes in system design and task complexity. Dissert. Abstr.

N74-20728* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
METABOLIC ANALYZER Patent
John A. Rummel and Cortes L. Perry, inventors (to NASA) Issued 26 Mar. 1974 13 p Filed 26 Dec. 1972 Supersedes N73-15156 (11 - 06, p 0635)
(NASA-Case-MFS-21415-1; US-Patent-3,799,149; US-Patent-Appl-SN-318152; US-Patent-Class-128-2.07; US-Patent-Class-73-23; US-Patent-Class-73-421.5R; US-Patent-Class-128-2.08) Avail: US Patent Office CSCL 06B

An apparatus is described for the measurement of metabolic rate and breathing dynamics in which inhaled and exhaled breath are sensed by sealed, piston-displacement type spirometers. These spirometers electrically measure the volume of inhaled and exhaled breath. A mass spectrometer analyzes simultaneously for oxygen, carbon dioxide, nitrogen and water vapor. Computation circuits are responsive to the outputs of the spirometers, mass spectrometer, temperature, pressure and timing signals and compute oxygen consumption, carbon dioxide production, minute volume and respiratory exchange ratio. A selective indicator provides for read-out of these data at predetermined cyclic intervals.
Official Gazette of the U.S. Patent Office

N74-20729*# Rancho Los Amigos Hospital, Inc., Downey, Calif. Amputee and Fracture Service.
INVESTIGATION OF THE MEDICAL APPLICATIONS OF THE UNIQUE BIOCARBONS DEVELOPED BY NASA Final Project Report
Vert Mooney 31 Aug. 1973 41 p
(Contracts NAS8-28620; NAS8-28117)
(NASA-CR-120194) Avail: NTIS HC $5.25 CSCL 06E

The biocompatibility of percutaneous endoskeletal fixation devices made from carbon compounds, and their applications are considered. The clinical application of these carbons to solve human problems is demonstrated and the nature of myoelectric simulation by carbon implants is studied. G.G.

N74-20730# Technische Hogeschool, Delft (Netherlands). Afdeling der Werktuigbouwkunde.
MAN-MACHINE SYSTEMS GROUP Progress Report, Jan. 1970 - Jan. 1973
H. G. Stassen, P. L. Brinkman, J. S. M. J. VanDieten, M. F. W. Dubois, J. J. Kok, A. VanLunteren, W. C. J. Moolenaar, A. J. DeRon, H. A. UdodeHaes, and W. Veldhuyzen Nov. 1973 328 p refs
(WTHD-55) Avail: NTIS HC $19.50

The research activities are reported for the period of January to October 1972. Topics discussed include: systems identification, function methods, bicycle simulator, tacticle tracking, modeling the helmsman of a supertanker, human adaptive control, and studies of the electroencephalogram of the human operator.
F.O.S.

N74-20731*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
RIDE QUALITY - AN EXPLORATORY STUDY AND CRITERIA DEVELOPMENT
Ralph W. Stone, Jr. Feb. 1974 34 p refs
(NASA-TM-X-71922; L-9296) Avail: NTIS HC $4.75 CSCL 05E

The Langley six degree of freedom visual motion simulator has been used to measure subjective response ratings of the ride quality of eight segments of flight, representative of a wide variation in comfort estimates. The results indicate that the use of simulators for this purpose appears promising. A preliminary approach for the development of criteria for ride quality ratings based on psychophysical precepts is included. Author

N74-20732# Advisory Group for Aerospace Research and Development, Paris (France).
THE USE OF NYSTAGMOGRAPHY IN AVIATION MEDICINE
Fred E. Guedry, Jr., ed. (Naval Aerospace Med. Res. Inst.) Dec. 1973 184 p refs Partly in FRENCH and in ENGLISH Presented at the AGARD Aerospace Med. Panel Specialists Meeting, Pensacola, Fla., 14-15 May 1973
(AGARD-CP-128) Avail: NTIS HC $12.25

Laboratory and clinical application techniques of nystagmography are reported with emphasis on motion sickness, spatial disorientation, and vertigo as experienced by flying personnel and divers. For individual titles, see N74-20733 through N74-20755.

N74-20733 Tulane Univ., New Orleans, La. School of Medicine.
CLINICAL APPLICATION OF NYSTAGMOGRAPHY
Wallace Rubin *In* AGARD The Use of Nystagmography in Aviation Med. Dec. 1973 3 p (For availability see N74-20732 12-05)

There are two specific clinical advantages of electronystagmography (ENG): (1) It is possible to detect spontaneous and positional nystagmus that would not be seen without its use; and (2) it is possible to differentiate peripheral from central pathology, and right sided from left sided peripheral lesions, when there is a spontaneous nystagmus. Author

N74-20734 Minnesota Univ., Minneapolis. School of Medicine.
PRACTICAL PROBLEMS IN CLINICAL NYSTAGMOGRAPHY. 1. GUIDELINES FOR SELECTION OF EQUIPMENT
Mary Jayne Capps *In* AGARD The Use of Nystagmography in Aviation Med. Dec. 1973 3 p refs (For availability see N74-20732 12-05)

The basic equipment needed for a thorough evaluation of the vestibular system includes an examination chair or table, a polygraphy suitable for recording nystagmus, a device for producing caloric stimuli, and an optokinetic stimulator. The required and optional features of each of these devices have been discussed. The basic equipment will permit the elicitation and recording of the various types of eye movements, i.e., caloric, optokinetic, positional, and spontaneous nystagmus. The evaluation of these phenomena provides a sufficiently complete picture of the state of the vestibular system. Author

N74-20735 Ohio State Univ., Columbus. Coll. of Medicine.
PRACTICAL PROBLEMS IN CLINICAL NYSTAGMOGRAPHY. 2. SOURCES OF ERROR
Charles W. Stockwell and William E. Collins (FAA, Oklahoma City) *In* AGARD The Use of Nystagmography in Aviation Med. Dec. 1973 10 p refs (For availability see N74-20732 12-05)

The value of clinical nystagmography can be greatly diminished if certain errors are not recognized and avoided. Some errors are introduced by faulty recording techniques, including inadequate calibration, inappropriate choice of frequency filters, and failure to identify artifacts. Other errors are due to the extreme sensitivity of the nystagmus response to extravestibular influences. Caloric testing errors include inadequate stimulus control and failure to account for directional preponderance. These and other errors in nystagmography are pointed out and discussed, and corrective measures are suggested. Author

N74-20736 Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
USE OF NYSTAGMOGRAPHY IN THE STUDY OF AIRCREW WITH SPATIAL DISORIENTATION
A. J. Benson *In* AGARD The Use of Nystagmography in Aviation Med. Dec. 1973 13 p refs (For availability see N74-20732 12-05)

Lateral nystagmus evoked by a stopping stimulus of 60 deg/sec was recorded by electro-oculography in 133 aircrew who had come under medical care because of airsickness, spatial disorientation, or other sensory disturbances in flight without illusory perception of aircraft orientation. Measures of the slow phase velocity, the time constant of decay and total amplitude of the post-rotational nystagmus, did not differ between the three groups. Measures of directional preponderance were found to have differences in variance structure between the groups. Measures of directional preponderance were found to have differences in various structure between the groups, but these were not well defined and hence of limited value in the selection or assessment of individual aircrew. Author

N74-20737 Centre Principal d'Expertises Medicales du Personnel Navigant, Paris (France).
A PROPOSED HABITUATION LABYRINTH (PRESENTATION

OF SEVERAL RESULTS WITH THE P.N.T) [A PROPOS DE L'HABITUATION LABYRINTHIQUE (PRESENTATION DE QUELQUES RESULTATS CHEZ LA P.N.T.)]

A. Gibert, P. Blanc, E. Lafontaine, P. Pialoux, and P. Fontelle *In* AGARD The Use of Nystagmography in Aviation Med. Dec. 1973 7 p In FRENCH (For availability see N74-20732 12-05)

Several methods, with special emphasis on damp sinusoidal stimulation, used to study labyrinth are introduced. Data are also given on the possible application of these methods in aeronautical and aerospace medicine. Habituation phenomena using the personnel navigation technique are given as well as information obtained by observing the phenomena in the course of professional apprenticeship. The possibility of observing the equilibration function during professional life, particularly during the course and abatement of the central peripheral vertiginous syndrome was discussed. Transl. by E.H.W.

N74-20738 Hopital d'Instruction des Armees, Versailles (France).

INTEREST OF NYSTAGMOGRAPHY IN FLYING NAVIGATION PERSONNEL [INTERET DE LA NYSTAGMOGRAPHIE DANS LE PERSONNEL NAVIGATION DE L'AVIATION]

L. R. Bordes *In* AGARD The Use of Nystagmography in Aviation Med. Dec. 1973 6 p In FRENCH (For availability see N74-20732 12-05)

The use of electronystagmography to diagnose psycholabyrinth, hyporeflective and barotrumatism vestibula, and peripherial, radicular, and central syndromes in navigation personnel is discussed. Test results are included along with data on the possible use of the method as an aid in selecting navigation personnel. Transl. by E.H.W.

N74-20739 Italian Air Force Aerospace Medical Center, Rome.

A CONTRIBUTION TO THE ELECTRONYSTAGMOGRAPHIC METHOD CONCERNING THE INTERPRETATION OF NYSTAGMUS CHARACTERISTICS

C. Koch *In* AGARD The Use of Nystagmography in Aviation Med. Dec. 1973 5 p refs (For availability see N74-20732 12-05)

The evaluation of nystagmic characteristics is stressed, both from a quantitative and qualitative standpoint. Descriptions of some of them (amplitude, frequency, duration) are given, the importance of which is well known as far as vestibular semiology and diagnostics are concerned. A new formula is proposed concerning the interpretation of the electronystagmographic recording. This formula makes it easier to define the nystagmus in degrees, thus constituting a basis for its classification. Author

N74-20740 Illinois Univ., Chicago. Abraham Lincoln School of Medicine.

DIFFERENTIAL DIAGNOSIS OF THE CALORIC NYSTAGMUS

Nicholas Torok *In* AGARD The Use of Nystagmography in Aviation Med. Dec. 1973 11 p refs (For availability see N74-20732 12-05)

Diagnostic considerations based upon the nystagmogram are limited. Quantitative assessment of horizontal canal sensitivity is available through the use of culmination frequency or culmination slow phase velocity. Three distinctive qualitative features of the caloric nystagmus were evaluated and were found to be suggestive or outrightly pathognomonic for retrolabyrinthine or central nervous system abnormalities. These are: (1) vestibular decruitment; a disproportionate caloric responsiveness when a weak stimulus elicits a more intense nystagmic reaction than a strong stimulus is capable of creating; (2) hyperactive vestibular responsiveness; and (3) ocular fixation reversal phenomenon. Elimination of fixation decreases the nystagmus intensity instead of facilitating the evoked nystagmus. Author

N74-20741 McGill Univ., Montreal (Quebec). Dept. of Physiology.

NYSTAGMOGRAPHY: A USEFUL TOOL IN BASIC AND APPLIED INVESTIGATIONS

G. Melvill Jones *In* AGARD The Use of Nystagmography in Aviation Med. Dec. 1973 13 p refs (For availability see N74-20732 12-05)

Relatively gross eye movements are considered: in particular, (1) quick, saccadic, gaze shifts from one fixation point to another; (2) the relatively slow smooth pursuit movements associated with following a fixation point which is moving relative to the head. In many circumstances these two types of movement are integrated to produce a combined pattern of eye movement suitable for intermittent fixation on a visual field which is moving relatively to the head. Methods of recording nystagmus and its data reduction are discussed, together with their applicability and hazards, in relation to intended objectives. The experimental use of nystagmography is treated in terms of quick and slow phase eye movements and of head movements. Author

N74-20742 Toronto Univ. (Ontario). Dept. of Otolaryngology.

OPTOKINETIC NYSTAGMUS: ITS VALUE IN THE DIAGNOSIS OF CERTAIN VESTIBULAR LESIONS

Y. Morissette, S. M. Abel, and H. O. Barber *In* AGARD The Use of Nystagmography in Aviation Med. Dec. 1973 6 p refs (For availability see N74-20732 12-05)

Optokinetic nystagmus (OKN) was studied to explore its value in the localization of vestibular lesions. The stimulus consisted of a field of equidistant, parallel black bars - either horizontal or vertical - moving across a white ground. The data showed that for subjects with normal vestibular function and unilateral labyrinthectomy, the slow phase velocity of OKN varied nonmonotonically with increases in the speed of the bars between 20 and 400 degrees of visual angle per second. This function reached a single maximum at approximately 60 to 80 degrees of bar velocity for horizontal OKN and at 40 degrees for vertical OKN. In subjects with neurological confirmed lesions of brain stem due to multiple sclerosis, tumor or ischemic disease, the slow phase velocity of OKN did not change, but remained constant at about 20 degrees/sec. across the range of bar velocities studied. Author

N74-20743 Mount Sinai Medical and Graduate Schools, New York. Dept. of Neurology.

VISUAL-VESTIBULAR INTERACTION: THE ROLE OF THE LABYRINTH IN THE PRODUCTION OF OPTOKINETIC NYSTAGMUS AND OPTOKINETIC AFTER-NYSTAGMUS

B. Cohen, S. Takemori, and T. Uemura *In* AGARD The Use of Nystagmography in Aviation Med. Dec. 1973 4 p refs (For availability see N74-20732 12-05)

OKN and OKAN were affected by unilateral and bilateral labyrinthectomy. The maximum velocity of slow phases of OKN induced by drum rotations above 60-75 deg/sec in either direction was lower after unilateral and bilateral labyrinthectomy. The frequency of OKN was also decreased, and the total deviation of the eyes was reduced for OKN induced by these drum speeds. Changes in OKN eventually recovered. OKAN was reduced in duration after unilateral labyrinthectomy, being initially shorter to the ipsilateral than to the contralateral side. OKAN could no longer be evoked after bilateral labyrinthectomy. This loss was permanent. These data demonstrate the importance of the vestibular system in maintenance of OKN and OKAN. Author

N74-20744 Freiburg Univ. (West Germany). Dept. of Neurology and Neurophysiology.

SELF-MOTION SENSATION, PSEUDO-CORIOLIS EFFECTS AND MOTION SICKNESS INDUCED BY OPTOKINETIC STIMULI

Johannes Dichgans and Thomas Brandt *In* AGARD The Use of Nystagmorgraphy in Aviation Med. Dec. 1973 3 p refs (For availability see N74-20732 12-05)

Psychophysiological experiments reported establish that the human sensation of self-motion is evoked by stimulation of the labyrinthine receptors as well as by excitation of the visual sense. Circularvection, pseudo-coriolis effect, and visually induced tilt of the apparent vertical produce oculogravic motion illusions and motion sickness phenomena due to vestibular-visual interaction. G.G.

N74-20745 Miami Univ., Oxford, Ohio. Dept. of Psychology.

EFFECTS OF SOUND ON THE VESTIBULAR SYSTEM

D. E. Parker, M. F. Reschke, and R. L. Tubbs *In* AGARD The Use of Nystagmography in Aviation Med. Dec. 1973 12 p refs (For availability see N74-20732 12-05)

(Contracts F33615-69-C-1246; F33615-73-C-4002)

The effects of sound on the vestibular systems of guinea

pigs and monkeys were studied. Sound stimuli included; (1) Pressure transients; (2) infrasounds, and (3) intense audiofrequency sound. Biomechanical and physiological responses to these three types of stimuli were observed. Biomechanical responses examined included stape displacement and perilymph pressure changes. Vestibular nerve activity, eye movements, and head movements are the physiological responses that were recorded. Monkey responses differed from guinea pig responses under several conditions; response differences suggest different mechanisms of acoustical vestibular stimulation in these two species. Author

N74-20746 Florida Univ., Gainesville. Div. of Otolaryngology.
NORMAL LIMITS FOR THE SEQUENTIAL BITHERMAL BINAURAL CALORIC TEST
Franklin O. Black, David D. Custer (Tech.-Vocational Inst.), William G. Hemenway (Colo. Univ.), and John I. Thornby *In* AGARD The Use of Nystagmography in Aviation Med. Dec. 1973 9 p refs (For availability see N74-20732 12-05)

Analysis of bithermal binaural caloric test results gave a statistically significant response difference between ears for right handed normal subjects. There were no significant response differences due to temperature of stimulation and ear stimulated. Three tests for the determination of caloric nystagmus response abnormalities were developed, based upon analysis of intrasubject normal responses. A retrospective examination of caloric responses from patients with Meniere's disease provided preliminary support for clinical feasibility and increased sensitivity of the statistical methods advocated for clinical usage. Author

N74-20747 Mainz Univ. (West Germany). Dept. of Physiology.
HUMAN EYE MOVEMENTS DURING VARIOUS FORMS OF LINEAR ACCELERATION AND WEIGHTLESSNESS
R. J. VonBaumgarten, R. Thumler (Mich. Univ.), G. L. Shillinger, Jr. (NASA. Ames Res. Center), and G. Baldrighi (Mich. Univ.) *In* AGARD The Use of Nystagmography in Aviation Med. Dec. 1973 3 p refs (For availability see N74-20732 12-05)

Eye movements of human subjects were recorded electronystagmographically in complete darkness during rectilinear horizontal accelerations as achieved in cars on the ground and also during aircraft parabolic flight. The results were compared to the movements of blinded goldfish subjected to similar changes of gravitoinertial forces. The results indicate that there is a human correlation with the gravity reference response of fish. During horizontal forward accelerations on the ground the human eyes turn downward and during horizontal backward acceleration the eyes turn upward. The human eye response to g-loads below 1 g and to weightlessness is the reverse of the tilt of the fish. While fish dive down during low g, or loop forward during weightlessness, the eyes of subjects sitting upright in an aircraft which flies at 0 g move upward. Author

N74-20748 Ludwig-Maximilians-Universitat, Munich (West Germany).
THERMOELECTRIC STIMULATION OF THE LABYRINTH
Hans Scherer *In* AGARD The Use of Nystagmography in Aviation Med. Dec. 1973 5 p (For availability see N74-20732 12-05)

A new method of caloric labyrinth stimulation is described. The use of water as a stimulator is replaced by a copper plug positioned in the external ear canal. The plug's temperature is regulated by Peltier thermoelectric plates which are connected with a power supply and are able to produce on one of their sides either heat or cold. Every temperature necessary to stimulate the labyrinth can be applied. Electronic steering and the automatization of the whole test are easily applicable. The new method is especially useful in patients with lesions of the ear drum. Several typical examples of thermoelectric stimulation of the labyrinth and the nystagmic response are shown. Author

N74-20749 Ulm Univ. (West Germany). Dept. of Neurology.
COMPUTER-ELECTRONYSTAGMOGRAPHY IN EVALUATING THE INFLUENCE OF PSYCHO-PHARMACOLOGICAL DRUGS ON VIGILANCE
Juergen C. Aschoff and Wolfgang Becker *In* AGARD The Use of Nystagmography in Aviation Med. Dec. 1973 8 p refs (For availability see N74-20732 12-05)

Maximum velocity and duration of saccadic eye movements depend entirely on the magnitude of angular deflection of the eye ball, and on the state of alertness or fatigue. Tranquilizing drugs such as Diazepam are known to reduce significantly the maximum velocity, but accuracy and reaction time of these eye movements deteriorate, too. For evaluating these drugs, an on-line computer program has been developed whereby 500 saccadic eye movements are computed for their maximum velocity, duration, accuracy and reaction time. All desired parameters are plotted in amplitude subgroups with mean values + or - standard deviation. Various drugs have been tested using this method including a powerful new antidepressant drug Sulpiride. This antidepressant psychopharmakon showed no influence on velocity and reaction time and may even enhance accuracy of saccadic eye movements. Author

N74-20750 School of Aerospace Medicine, Brooks AFB, Tex. Clinical Sciences Div.
AEROMEDICAL RESEARCH AND CLINICAL APPLICATIONS OF AVERAGING TECHNIQUES IN NYSTAGMOGRAPHY
James W. Wolfe *In* AGARD The Use of Nystagmography in Aviation Med. Dec. 1973 6 p refs (For availability see N74-20732 12-05)

A system employing analog-to-digital techniques has been developed for simultaneously measuring the average slow and fast phase velocity of the summated response and left and right eye movements separately and for precisely resolving both of these variables. This method is described along with illustrative cases. Preliminary results indicate that this approach may be useful in differentiating peripheral and central vestibulo-oculomotor pathology. Author

N74-20751* Massachusetts Inst. of Tech., Cambridge. Man-Vehicle Lab.
AUTOMATED NYSTAGMUS ANALYSIS
Charles M. Oman, John H. J. Allum, John R. Tole, and Laurence R. Young *In* AGARD The Use of Nystagmography in Aviation Med. Dec. 1973 9 p refs (For availability see N74-20732 12-05)
(Grants NGR-22-009-025; NGR-22-009-156; NGR-22-009-701)

Several methods have recently been used for on-line analysis of nystagmus: A digital computer program has been developed to accept sampled records of eye position, detect fast phase components, and output cumulative slow phase position, continuous slow phase velocity, instantaneous fast phase frequency, and other parameters. The slow phase velocity is obtained by differentiation of the calculated cumulative position rather than the original eye movement record. Also, a prototype analog device has been devised which calculates the velocity of the slow phase component during caloric testing. Examples of clinical and research eye movement records analyzed with these devices are shown. Author

N74-20752 Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
A MODEL FOR THE PREDICTION OF THE NYSTAGMIC RESPONSE TO ANGULAR AND LINEAR ACCELERATION STIMULI
G. R. Barnes and A. J. Benson *In* AGARD The Use of Nystagmography in Aviation Med. Dec. 1973 13 p refs (For availability see N74-20732 12-05)

A model has been developed for the mechanism of saccadic generation in the vestibulo-ocular reflex arc, in an attempt to explain variations in the pattern of nystagmic response to vestibular stimulation. The model has been developed using an analogue computer and an attempt has been made to relate the system to the known physiological evidence. The response of the model has been compared with results from experiments on human subjects, and satisfactory agreement has been obtained in conditions appropriate to stimulation of the canals by both periodic and transient angular accelerations and to stimulation of the utricular maculae by linear acceleration. The model effectively simulates the changes in frequency and duration of slow phase and saccadic eye movements observed experimentally. Author

N74-20753 Royal Australian Navy School of Underwater Medicine, Balmoral.

VERTIGO IN DIVING
Carl Edmonds *In* AGARD The Use of Nystagmography in Aviation Med. Dec. 1973 10 p refs (For availability see N74-20732 12-05)

Because vertigo is associated with nystagmus and this can be demonstrated in an objective manner, it has been attempted to differentiate the specific causes of vertigo from those of disorientation in general. It is fully appreciated that there is a strong correlation between these two symptoms. An aetiological classification of vertigo in diving is reported that considers aspects of unequal vestibular stimulation as well as unequal vestibular responses. Author

N74-20754 Duke Univ., Durham, N.C. Div. of Otolaryngology.
COCHLEAR AND VESTIBULAR INJURIES DURING DIVING
Joseph C. Farmer, Jr. *In* AGARD The Use of Nystagmography in Aviation Med. Dec. 1973 8 p refs (For availability see N74-20732 12-05)

Cochlear and vestibular damage can occur during all phases of diving. Inner ear damage during compression seems to be related to difficulties with middle ear pressure equalization while such damage occurring at stable deep depths seems to be related to experimental changes in inspired inert gas composition. Cochlear and vestibular damage during decompression seems to be a form of decompression sickness and can be the only manifestation of this problem. Twenty cases of such damage are presented in which there is a significant correlation between prompt recompression treatment and lack of residual deficites. Excessive noise is not uncommon during various diving conditions and can lead to temporary and presumably permanent auditory thresholds shifts. Author

N74-20755 Lund Univ. (Sweden). ENT-Dept.
EFFECTS OF INCREASED MIDDLE EAR PRESSURE ON THE VESTIBULAR SYSTEM
Oerjan Tjernstroem *In* AGARD The Use of Nystagmography in Aviation Med. Dec. 1973 9 p refs (For availability see N74-20732 12-05)

A technique is described for measuring changes in pressure in the middle ear. Fitted to the external ear canal is a rubber cuff which contains a small tube. A flowmeter, parallel with the tube, detects airflow between the external ear canal and the ambient air. The airflow is compared electronically with a reference airflow in another tube which emanates from an adjustable reference volume. By recording in this manner in a pressure chamber, pressure changes in the middle ear could be related to report vertigo and also to recorded nystagmus. Results indicate that alternobaric vertigo (A.V.) may occur with only moderate pressure changes and that some subjects who would otherwise be regarded as normal are especially susceptible to A.V., apparently as a result of a high forcing pressure on one side. Author

N74-20756# Advisory Group for Aerospace Research and Development, Paris (France).
ESCAPE PROBLEMS AND MANOEUVRES IN COMBAT AIRCRAFT
Walton L. Jones, ed. (NASA, Washington, D. C.) Feb. 1974 121 p refs Papers Presented at Aerospace Med. Panel Specialists, Soesterberg, Netherlands, 4 Sep. 1973 (AGARD-CP-134) Avail: NTIS HC $9.25

The proceedings of a conference on the subject of problems of escape from rotary wing and V/STOL aircraft are presented. The purpose of the meeting was to delineate the important aspects of the escape problems and to review new concepts in escape technology. The subjects covered was broad ranging from biomedical issues in air combat mishaps in high performance aircraft to human factors and engineering aspects of inflight escape in all types of aircraft. For individual titles, see N74-20757 through N74-20772.

N74-20757* National Aeronautics and Space Administration, Washington, D.C.
TECHNICAL EVALUATION OF THE AEROSPACE MEDICAL PANEL SPECIALISTS MEETING ON ESCAPE PROBLEMS AND MANOEUVRES IN COMBAT AIRCRAFT
Walton L. Jones *In* AGARD Escape Probl. and Manoeuvres in Combat Aircraft Feb. 1974 6 p (For availability see N74-20756 12-05)

A technical evaluation of the papers presented at a conference on escape systems for helicopters and V/STOL aircraft was made. The subjects discussnd include the following: (1) bioengineering aspects of spinal injury during ejection, (2) aerodynamic forces acting on crewman during escape, (3) operational practicality of fly away ejection seats, (4) helicopter survivability requirements, (5) ejection experience from V/STOL aircraft, and (6) research projects involving escape and retrieval systems. Author

N74-20758 Bureau of Medicine and Surgery, Washington, D.C.
SPECIFIC BIOMEDICAL ISSUES IN THE ESCAPE PHASE OF AIR COMBAT MISHAPS DURING SOUTHEAST ASIA OPERATIONS
Robert E. Kinneman, Jr., Martin G. Every (BioTechnology, Inc., Falls Church, Va.), and James F. Parker, Jr. (BioTechnology, Inc., Falls Church, Va.) *In* AGARD Escape Probl. and Manoeuvres in Combat Aircraft Feb. 1974 7 p refs (For availability see N74-20756 12-05)

Escape and rescue data were collected from Navy airmen downed over Southeast Asia in order to isolate significant biomedical problems associated with the combat mishap. Subjects consisted of naval aviators flying fixed-wing jet aircraft who were forced to eject as a direct result of enemy action. One hundred and fifteen survivors of such an occurrence were located and administered an extensive questionnaire covering the circumstances associated with the escape and all events prior to and during rescue. Particular attention was given to the adequacy of escape and rescue systems under Southeast Asia combat conditions. This paper deals with the analyses that were conducted in order to determine specific cause and effect relationships for injuries incurred during the ejection phase of this event. Conclusions of the study deal with the adequacy of escape equipment and procedures, under the conditions and stresses inherent in combat situations. Author

N74-20759 Naval Aerospace Medical Research Lab., New Orleans, La.
BIOENGINEERING ASPECTS OF SPINAL INJURY IN THE OV-1 (MOHAWK) AIRCRAFT **c04**
Channing L. Ewing and Daniel J. Thomas *In* AGARD Escape Probl. and Manoeuvres in Combat Aircraft Feb. 1974 9 p refs (For availability see N74-20756 12-05)

An investigation of non-fatal ejection verterbral fracture encountered during ejection from military aircraft was conducted. The causes for the injuries are analyzed. Laboratory procedures for determining the factors which contribute to spinal injuries during ejection are reported. It was concluded that the restraint harness used in the OV-1 aircraft was responsible for the high incidence of spinal injuries encountered by crewmen ejecting from this aircraft. Author

N74-20760 Naval Aerospace Medical Research Lab., New Orleans, La.
HEAD CLEARANCE ENVELOPE FOR EJECTION SEATS DURING NEGATIVE G sub x IMPACT ACCELERATION
Channing L. Ewing *In* AGARD Escape Probl. and Manoeuvres in Combat Aircraft Feb. 1974 3 p refs (For availability see N74-20756 12-05)

Living volunteers from the U.S. Army participated in a research program designed to determine response of the living human head and neck to impact acceleration in 1967-1969. The restraint system used was typical of that described above and included a 3-inch lap belt, and inverted V, and shoulder straps. The seat was an experimental seat with the level steel seat pan parallel with the ground and the steel seat back vertical to the seat pan. The shoulder harness in all cases came straight out from the seat back to the shoulder via an adjustable spreader and then downward across the clavicles to the lap belt. The subjects so restrained were given a minus G sub x impact acceleration with fixed rate of onset and with fixed peak acceleration. The run selected for this study was that performed by an 88th percentile sitting height subject (relative to U.S. Navy pilot data), at 10G, 800G/sec with a triangular pulse, lasting about 400 ms. The subject was fitted with transducer mounts on the top of the head; mouth; and base of the neck. These mounts were rigidly attached to the anatomy and photographic targets

were attached to each mount, with two targets separated by several inches attached to the neck mount. Author

N74-20761 Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
AN ASSESSMENT OF AERODYNAMIC FORCES ACTING ON THE CREWMAN DURING ESCAPE
James W. Brinkley and Peter R. Payne (Payne, Inc., Annapolis) *In* AGARD Escape Probl. and Manoeuvres in Combat Aircraft Feb. 1974 10 p refs (For availability see N74-20756 12-05)

The results of analytical and experimental research accomplished to determine the magnitude of the aerodynamic forces acting on the crewman during emergency escape are summarized. The work has been directed toward the definition of the mechanisms of aerodynamic flail injury and the acquisition of data required for the development of protective countermeasures. The results of a study of noncombat ejection experience within the U.S. Air Force during the period of 1964 to 1972 are also reviewed. This study was conducted to identify injuries attributed to aerodynamic loads and to statistically describe the probability of these injuries as a function of aircraft speed at the time of ejection. Wind tunnel experiments are described which were conducted to measure the forces acting on body segments using volunteer human subjects. Both open ejection seat and tractor rocket extraction egress systems were studied. The data collected from these experiments includes whole body and body segment aerodynamic forces. Operational variables such as arm and leg position and clothing were evaluated to determine their relative effects on the aerodynamic loads acting on the subject's limbs. Author

N74-20762 Naval Aerospace Recovery Facility, El Centro, Calif.
AEROMEDICAL RESEARCH AND EVALUATION SUPPORT OF EXISTING AND PROPOSED ESCAPE AND RETRIEVAL SYSTEMS AT THE NAVAL AEROSPACE RECOVERY FACILITY
Donald H. Reid *In* AGARD Escape Probl. and Manoeuvres in Combat Aircraft Feb. 1974 8 p refs (For availability see N74-20756 12-05)

A research facility for conducting physiological research with parachutists and for investigating hardware system/human performance interface problems is described. The objective of the research projects has been to contribute data which are needed by the engineering disciplines in designing and developing new generation retardation and recovery systems which are acceptable from the human engineering standpoint. Specific programs in human factors engineering of emergency equipment for air crew use are reported. Author

N74-20763 Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
OPERATIONAL PRACTICALITY OF FLY AWAY EJECTION SEATS **c03**
R. Harley Walker, Jr. *In* AGARD Escape Probl. and Manoeuvres in Combat Aircraft Feb. 1974 15 p refs (For availability see N74-20756 12-05)

In the interest of improving the current escape/rescue capability, a concept which provides the ejectee with increased time available for rescue by allowing him to remain airborne out of small arms fire range and to fly with a high degree of maneuverability to a more secure, accessible area for landing and pickup is being investigated. This advanced Crew Escape and Rescue Capability, AERCAB, system provides the aircrewman with a secondary flight vehicle capable of gaining or maintaining altitude and permits him to assist in his own rescue by navigating over a limited range at a specified cruise speed out of the hostile target area toward predetermined safe sites where terminal pickup by friendly forces can be made with the least jeopardy. Thus, the AERCAB or fly away ejection system is a new dimension in airborne escape. An assessment of the potential operational practicality and effectiveness of the AERCAB system is presented. The advantages and disadvantages of the fly away escape concept in the operational environment are discussed including any penalties imposed on the tactical aircraft and missions. The probability of rescue is shown to be improved with an AERCAB system. The approach for determining the effective cost of a deployed AERCAB system is discussed. Author

N74-20764 Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
EJECTION EXPERIENCE FROM VTOL MILITARY AIRCRAFT
D. C. Reader *In* AGARD Escape Probl. and Manoeuvres in Combat Aircraft Feb. 1974 3 p (For availability see N74-20756 12-05)

A statistical analysis of ejections from the Harrier aircraft is presented. The data are contained in a table which describes the conditions for the fourteen successful and four fatal ejections on record. It is stated that the majority of the ejections occurred at low speed and low altitude with the aircraft sinking and/or banked. Author

N74-20765 Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
CLEARANCE OF EJECTION PATH BY THE USE OF EXPLOSIVE CORD
A. J. Barwood *In* AGARD Escape Probl. and Manoeuvres in Combat Aircraft Feb. 1974 6 p (For availability see N74-20756 12-05)

The use of miniature detonating cord (MDC) for removing an aircraft canopy prior to ejection is discussed. The design of the MDC and the installation on specific aircraft are described. The main points in favor of using MDC are: (1) it rapidly clears the ejection path, (2) it breaks the central area of the canopy into small fragments thus avoiding major impact on ejecting crew members, and (3) all canopy debris flies outward. Author

N74-20766 Naval Air Development Center, Warminster, Pa. Crew Systems Dept.
ADVANCED CONCEPTS FOR ROTARY WING AND V/STOL AIRCRAFT ESCAPE SYSTEMS **c03**
William G. Law *In* AGARD Escape Probl. and Manoeuvres in Combat Aircraft Feb. 1974 5 p refs (For availability see N74-20756 12-05)

The requirements for ejection seats to provide safe egress from helicopters and V/STOL aircraft are discussed. The limitations of existing ejection seats for such applications are defined. The desirability of a display device for indicating safe ejection conditions to the crew members is expressed. The research projects which have been conducted in an effort to develop a more satisfactory ejection system are reported. Author

N74-20767 Naval Air Systems Command, Washington, D.C.
HELICOPTER PERSONNEL SURVIVABILITY REQUIREMENTS
T. Stephen Meek *In* AGARD Escape Probl. and Manoeuvres in Combat Aircraft Feb. 1974 6 p ref (For availability see N74-20756 12-05)

Current provisions for countering helicopter in-flight emergencies are discussed and their inadequacies are noted. To assess the need for improved helicopter occupant survivability, a review is presented of U. S. Navy, Marine Corps and Army helicopter fatal accident data. Analyses of these data have identified the survival mechanisms which could have prevented these fatalities. Practicable combinations of these survival mechanisms - (1) emergency in-flight egress, (2) improved crash impact protection, (3) improved fire protection and (4) improved flotation - could have averted more than 80 percent of the fatalities analyzed over a 17 year period. Author

N74-20768 Army Aeromedical Research Lab., Fort Rucker, Ala.
PARACHUTE ESCAPE FROM HELICOPTERS
William P. Schane *In* AGARD Escape Probl. and Manoeuvres in Combat Aircraft Feb. 1974 3 p refs (For availability see N74-20756 12-05)

A series of parachute jumps were made from an autorotating helicopter. The exit and separation of the parachutist from the helicopter were documented by 16mm motion pictures taken at 32 frames per second with a motion picture camera and by 35mm slides taken four frames per second by a motorized Nikon camera. The photo platform was a chase helicopter flying precise formation with the jump helicopter. Data were obtained with

frame by frame analysis of the motion pictures measuring the distance separating the parachutist from a reference point on the helicopter. The distance from the most anterior portion of the nose to the most posterior portion of the tail boom of the jump helicopter was used as a reference length. Approximate rates of descent of the jump helicopter during test were established using the vertical speed indicator aboard the jump helicopter. Precise rate of descent at the moment of parachutist exit was determined using a recording radar altimeter which provides precise altitude information above ground level. Author

N74-20769 Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
HUMAN FACTORS ASPECTS OF IN-FLIGHT ESCAPE FROM HELICOPTERS
D. C. Reader *In* AGARD Escape Probl. and Manoeuvres in Combat Aircraft Feb. 1974 4 p refs (For availability see N74-20756 12-05)

A review of the accident statistics from some helicopters users of the NATO forces has shown that helicopter operations impose a greater risk to their crews compared with fixed-wing aircraft. Cost analyses have shown that the crew cost more to replace than their aircraft. Thus, it is considered that a strong case exists for in-flight escape from helicopters. Some human factors to be considered when designing such a system are described. Human tolerance to acceleration, egress path requirements, center of gravity data, restraint and parachute requirements, blast, noise, fragmentation and toxic hazards, and vision and egress time requirements are discussed. Author

N74-20770 Institut fuer Flugmechanik, Brunswick (West Germany).
ESCAPE MEASURES FOR COMBAT HELICOPTER CREWS **c03**
H. D. Melzig and U. Schmidt *In* AGARD Escape Probl. and Manoeuvres in Combat Aircraft Feb. 1974 11 p refs (For availability see N74-20756 12-05)

Flight-control malfunction, loss of control, loss of main or tail rotor, mid-air collision, fire explosion and transmission freeze-up occur relatively often and cause emergency conditions which can not be followed by an auto-rotation landing. Together with a very high percentage of pilot error as the responsible reason for the emergency and the operational requirements for combat helicopters with low altitude and speed, in a relatively high number of accident fatalities could have only been avoided by means of an escape system. Although the technology of capable escape systems is highly developed, its application to a helicopter causes great difficulties because of the rotating blades. A comparative analysis is made for the different modes of downward, sideward, foward and upward ejection or extraction in correlation to the expected percentage of rescue from emergencies and a number of other factors, like development cost and time, reliability, human tolerance, adaptability for retrofit and others. Author

N74-20771 Army Aeromedical Research Lab., Fort Rucker, Ala.
ARMY AUTOROTATIONAL ACCIDENTS **c02**
Kent A. Kimball, Donald F. Harden, and Mark A. Hofmann *In* AGARD Escape Probl. and Manoeuvres in Combat aircraft Feb. 1974 10 p (For availability see N74-20756 12-05)

A study reviewing autorotation accidents was initiated to ascertain the relative contributions that certain factors had in such accidents. The active Army, for fiscal years 1970 through 1972, was reviewed and a total of 790 accidents, or 42.3% of all accidents, were of the autorotational type. They accounted for over 89 million dollars in aircraft damage, 92 aircrew fatalities and 652 aircrew injuries. Of these 790 accidents, it was determined that personnel error alone accounted for 32.7% of the accidents, while materiel failure alone accounted for 31.4%. Of the remaining accidents (35.9%), 20.9% were attributed to a combination of personnel error and materiel failure, while the remaining 15% were attributed to other causative factors. Though the total number and rate of rotary wing accidents was found to be declining over the time for frame considered, the number of autorotation accidents attributed solely to personnel error was found to be on the increase, with fiscal year 1972 approximately 10% higher than 1970. The study also reviews autorotation accidents in light of total accidents, rates, geographical areas, aircraft, cost, fatalities, and injuries. It also provides impact data with regard to the reduction of certain parameters. Author

N74-20772 Naval Air Development Center, Warminster, Pa.
IN-FLIGHT ESCAPE SYSTEM FOR HEAVY HELICOPTERS **c03**
William Ogden and Gary Davis (Naval Air Systems Command) *In* AGARD Escape Probl. and Manoeuvres in Combat Aircraft Feb. 1974 9 p refs (For availability see N74-20756 12-05)

The design and development of a helicopter escape and personnel survival system (HEPS) are discussed. The system contains four primary functions: (1) in flight escape, (2) crash impact energy attenuation, (3) fuel fire suppression, and (4) flotation. The configuration of the system is illustrated. Results of flight tests are reported. Author

N74-20773# Army Personnel Research Committee, London (England).
THE EFFECT OF VISCOUS DAMPING ON HAND TREMOR
M. Waygood Med. Res. Council Jul. 1972 11 p refs (APRC-72/CS-6; BR37716) Avail: NTIS HC $4.00

Power spectra of hand tremor were obtained from 12 operators of an electronic viscously damped control system. Analysis of the spectra indicate that tremor is unaffected by the application of a viscous load. The values of viscous resistance were in the range 0.0817 to 0.0163 gm. cm/deg. sec. These are small values intended for hand controls. Author (ESRO)

N74-20774# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
SIGNAL DETECTION THEORY (SDT) AS METHODOLOGICAL MEANS FOR HUMAN ENGINEERING TESTS [DIE SIGNALENTDECKUNGSTHEORIE (SDT) ALS METHODISCHES HILFSMITTEL FUER ANTHROPOTECHNISCHE UNTERSUCHUNGEN]
Hannelore Koethe May 1973 46 p refs In GERMAN; ENGLISH summary
(Anthro-Mitt-1/73) Avail: NTIS HC $5.50; Forschungsinst. Fuer Anthropotech., Meckenheim, West Ger. 6 DM

A survey of psychological scaling and classical threshold methods is given. Signal Detection Theory (SDT) offers theoretical explanations which overcome the problems of older psychophysical models. The introduction into the theoretical foundations of SDT is followed by a description of its methods. The applicability of SDT methods to anthropotechnical (human engineering) problems is described. Author (ESRO)

N74-20775# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
INVESTIGATIONS ON VALUE DISPLAYS ON SCREENS [UNTERSUCHUNGEN ZUR MESSWERTDARSTELLUNG AUF BILDSCHIRMEN]
E. Schubert Aug. 1973 96 p refs In GERMAN; ENGLISH summary
(FB-11) Avail: NTIS HC $8.00; Forschungsinst. Fuer Antrhropotech., Meckenheim, West Ger. 10 DM

Six different display systems (one analog, one digital and four hybrid displays) were compared as to their readability. Besides the display formats, the changing rate and the direction of change of the display value were varied. The introduction of the pointer velocity as an independent variable led to a suitable research method; a new dynamic procedure was developed and tested. Readability comparison for the various displays showed that hybrid displays are superior to the digital display, with the pure analog display showing the worst results. The effect of changing rate on reading performance was qualitatively the same for all examined displays; reading errors grew with increasing values for the rate of exchange. Author (ESRO)

N74-20776# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
MOTION PERCEPTION IN VEHICLE SIMULATORS [BEWEGUNGSWAHRNEHMUNG IN FAHRZEUGSIMULATOREN]
G. Tiesler Sep. 1973 97 p refs In GERMAN; ENGLISH summary
(FB-12) Avail: NTIS HC $8.00; Forschungsinst. fuer Anthropotech., Meckenheim, West Ger. 10 DM

A literature review on physiology of motion perception, as well as the resulting requirements for motion simulation is given. Several examples of simulators are used to point out the necessity of adapting capabilities to specific research and for training problems. The problem of interactions between visual and motion cues is demonstrated. Some examples out of biocybernetics illustrate the complex processing of cues in man.

Author (ESRO)

N74-20777# Defence Research Information Centre, Orpington (England).

VISUAL RANGE OF AN OBJECT IN THE ATMOSPHERE

M. Gazzi et al Jan. 1974 39 p refs Transl. into ENGLISH from Portata Visuale di un Oggetto Attraverso l'Atmosfera, IFA-STR-17, Ist. di Fis. dell'Atmosfera (Rome), Apr. 1972 38 p

(DRIC-Trans-3318; BR30636; IFA-SR-36) Avail: NTIS HC $5.00

The elementary principles forming the basis of vision in the atmosphere are presented and the requirement for mathematical models is noted. The factors on which vision of an object in the atmosphere depends are described. These include attenuation and light of the atmosphere and contrast threshold. Calculation of visual range is treated in detail. ESRO

N74-20778# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.

SEPARATION OF SIGNALS DUE TO ARTERIAL AND VENOUS BLOODFLOW, IN THE DOPPLER SYSTEM, THAT USES CONTINUOUS ULTRASOUND M.S. Thesis

W. P. Goes Jun. 1973 47 p refs

(TH-73-E-40; ISBN-90-6144-040-8) Avail: NTIS HC $5.50

The separation of arterial and venous bloodflow signals from a Doppler flowmeter using continuous ultrasound is discussed. The received signal may contain positive and negative frequency shifts; in many cases positive shifts can be related to arterial bloodflow and negative shifts to venous flow. The average frequency of the positive and negative spectra of the Doppler signal is determined, using a known technique. To make interpretation of the registrations easier a multiplicand, depending upon the ratio of the powers of positive and negative spectra, is added. ESRO

N74-20779# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.

A COMPARATIVE ANALYSIS OF SEVERAL MODELS OF THE VENTRICULAR DEPOLARISATION. INTRODUCTION OF A STRING MODEL

A. A. H. Damen Oct. 1973 59 p refs

(TH-73-E-41; ISBN-90-6144-041-6) Avail: NTIS HC $6.00

The familiar one dipole, multiple dipole, and multipole models of the electric heart action were tested on their suitability of simulating the field of double layers, which change in time. These double layers form part of a new model (string model) of the depolarization wave through the heart ventricles based on a gross physiological resemblance. The string model consists of two strings of dipoles that travel along the endocardium; the depolarization of the myocardium is represented by filters responding to the dipoles. If the well known models fail in a model-to-model test with the string model, it is to be expected that they also can not handle the more complex real situation. Furthermore, the string model itself may provide an expedient for tackling the so called direct and inverse problem of electrocardiography.

Author (ESRO)

N74-20780# European Space Research Organization, Paris (France).

CHANGES IN THE CIRCADIAN RHYTHM OF THE BODY TEMPERATURE AFTER TRANSMERIDIAN FLIGHTS

Joerg Mertens Feb. 1974 68 p refs Transl. into ENGLISH of Die Veraenderungen der Tagesperiodischen Schwankungen der Koerpertemp. nach Transmeridianen Fluegen, DLR-FB-73-01, DFVLR, 1973

(ESRO-TT-16; DLR-FB-73-01) Avail: NTIS HC $6.50, DFVLR Porz-Wahn: 21,40 DM

The oral body temperature of 12 pilots was measured at 2 hour intervals over 24 hour periods. In two test periods prior to the transmeridian flights the normal body temperature rhythm was established. Effects of a time displacement of eight hours were investigated by determining the body temperature after flights between Germany and U.S.A., the measurements taking place in each case on the first, third, fifth and eighth day after the flight. Desynchronization relative to the new local time was observed after flights in both directions, but the changes after the West-East were more pronounced than after the one in the opposite direction. The adaptation time after an East-West flight was five days, and after a West-East flight at least eight days. Large individual differences both in the degree of the changes and the duration of adaptation were noted. Author (ESRO)

N74-20781# European Space Research Organization, Paris (France).

THE CHANGE OF CIRCADIAN RHYTHMS OF PSYCHOMOTOR PERFORMANCE AFTER TRANSMERIDIAN FLIGHTS

Michael Bodanowitz Feb. 1974 52 p refs Transl. into ENGLISH of die Veraenderung Tagesperiodischer Schwankungen der Psychomotorischen Leistung Nach Transmeridianen Fluegen, DLR-FB-73-52, DFVLR, 1973

(ESRO-TT-17; DLR-FB-73-52) Avail: NTIS HC $5.75; Original report in GERMAN: DFVLR, Porz, West Ger. 15,30 DM

Psychomotor performance was studied in eight students at 3-hour intervals during periods of 24 hours before and after flights between Germany and the U.S.A. Two 24-hour preflight periods revealed the basic normal daily rhythm of the psychomotor performance. Effects of a 6-hour time shift were evaluated by determining the psychomotor performance on day 1, 3, 5, and 8 following the flights in each direction. A desynchronization with the local time was observed after flight in both directions. The changes were more pronounced and longer lasting after the west-east flight. The resynchronization time amounted to five days after the westward travel and to eight days after the eastward direction. Effects of a 6-hour time shift were evaluated by determining the psychomotor performance on day 1, 3, 5, and 8 following the flights in each direction. A desynchronization with the local time was observed after flight in both directions. The changes were more pronounced and longer lasting after the west-east flight. The resynchronization time amounted to five days after the westward travel and to eight days after the eastward direction. Author (ESRO)

N74-20782# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

PHYSIOLOGICAL EFFECTS OF WEARING THE FIRE PROXIMITY SUIT ON CRASH TRUCK ALERT STATUS TO HOT-DRY AND HOT-HUMID ENVIRONMENTS Final Report

Abbott T. Kissen, James J. Gerding, and Kenneth A. Miles Nov. 1973 14 p

(AF Proj. 7222)

(AD-773828; AMRL-TR-73-82) Avail: NTIS CSCL 06/1

Tests were conducted in the All Weather Test Facility to determine the physiologic penalty of wearing the fire fighter's proximity suit for a 2-hour alert cycle in the crash truck. Hot-dry and hot-humid environments were produced in the chamber which duplicated the most severe thermal conditions anticipated at hot weather bases. Three subjects wearing the proximity suit (except for gloves and helmet) were exposed (twice each) to either the hot-dry or hot-wet environments for 2 hours. In half of the tests, the proximity suit coat was also eliminated from the clothing assembly. For the given hyperthermic conditions, the 2-hour exposure periods do not elicit physiologic responses or symptoms indicative of incipient heat exhaustion although significant physiological decrements were observed. For operational relevancy, where a rescue procedure could be called for toward the conclusion of the thermal stress period, the suggestion is made to continue this effort with a series of tests in which an exercise regimen is superimposed on the thermal stress exposure. Author (GRA)

N74-20783# School of Aerospace Medicine, Brooks AFB, Tex.

THE USAFSAM SPATIAL ORIENTATION TRAINER: BACKGROUND AND APPARATUS Final Report, Sep. 1972 - Jun. 1973

Patrick J. Dowd Dec. 1973 18 p refs

(AF Proj. 7930)

(AD-772694; SAM-TR-73-46) Avail: NTIS CSCL 05/9

A prototype trainer has been developed for use as an aid in indoctrinating USAF pilots with spatial disorientation problems. Its main asset is that the pilot can control the trainer in four axes while his performance is recorded for analysis. The common spatial disorienting illusions are described, and their specific demonstrating procedures on the SOT. Specifications and capabilities of the trainer are presented. This trainer would be an effective training aid as well as serving as a valuable research tool for further study in motion simulators for training, in vestibular research, and in problems concerned with spatial disorientation and motion sickness. Author (GRA)

N74-20784# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

PRIMARY COMPONENTS OF SIMULATED AIR BAG NOISE AND THEIR RELATIVE EFFECTS ON HUMAN HEARING Final Report, Oct. 1972 - Mar. 1973

Henry C. Sommer and Charles W. Nixon Nov. 1973 22 p refs

(AD-773809; AMRL-TR-73-52) Avail: NTIS CSCL 13/12

The relative contributions to auditory temporary threshold shift (TTS) of the air bag vehicle volume displacement and of the high frequency noise burst associated with activation, air turbulence, unfolding, etc., of the system were investigated. Ten male university subjects with normal hearing were exposed to each of three conditions: (a) to a positive pressure pulse of 165 db peak pressure with a rise time of 65 ms and a duration of 960 msec; (b) to a high frequency noise burst in the 350 Hz-2 kHz band at 153 db rms with rise and fall times of 25 ms and a duration of 400 ms and (c) to a and b presented simultaneously. TTS was measured for 12 discrete frequencies ranging from 125 Hz to 12 kHz for each exposure condition. The high frequency noise burst produced the greatest amount of TTS. The positive pressure pulse produced no measurable changes in hearing levels. The two components occurring simultaneously resulted in less TTS than that produced by the noise burst alone. (Modified author abstract) GRA

N74-20785# Systems Technology, Inc., Hawthorne, Calif.

MANUAL CONTROL PERFORMANCE AND DYNAMIC RESPONSE DURING SINUSOIDAL VIBRATION Final Report, Jul. 1971 - Jun. 1972

R. Wade Allen, Henry R. Jex, and Raymond E. MagDaleno Oct. 1973 165 p refs

(Contract F33615-71-C-1487)

(AD-773844; STI-TR-1013-2; AMRL-TR-73-78) Avail: NTIS CSCL 05/8

A variety of dynamic response and performance measurements are presented for compensatory manual control tasks performed under both vertical, lateral, and fore-aft sinusoidal vibration. Special, on-line measurement techniques allowed the partitioning of error and control response variances into portions correlated with the tracking task and vibration inputs, and an uncorrelated or remnant portion. Vibration effects on visual-motor response were generally subtle, and the most sensitive effects occurred in error remnant and vibration-induced feedthrough to the control response. Dramatic increases in remnant were obtained under low-frequency lateral vibration with a low spring gradient displacement stick, while an isometric control showed little effect. As part of the study, body motion and control response measurements were used to develop biomechanical models of the vibration-to-control feedthrough process. Under vertical vibration a simplified model, based on the operator's seat-to-shoulder transmissibility and a quasi-rigid arm linkage, was found to give an adequate description of vibration feedthrough. (Modified author abstract) GRA

N74-20786# General Electric Co., Lynn, Mass. Direct Energy Conversion Programs.

SELF-CONTAINED AIRCRAFT OXYGEN. VOLUME 4: UNDERWATER BREATHING MODIFICATION Final Technical Report, Aug. 71 - Aug. 72

John H. Russell and John W. Harrison Sep. 1973 101 p

(Contract F33657-68-C-1076)

(AD-774077; ASD-TR-73-240-Vol-4) Avail: NTIS CSCL 06/11

Adaptation of the self-contained aircraft oxygen system (SCAOS) for Navy use formed a part of the overall development program. The main difference between Navy and Air Force practice as it affects the system is the use of a chest-mounted miniature breathing regulator by the Navy, while the baseline Air Force system employs panel-mounted regulators occupying the envelope of the CRU-68/A regulator. A primary design consideration for Navy use is the capability of the system to operate in a submerged and flooded cockpit to a depth of 33 feet. The chest-mounted regulator allows the aviator to be in any orientation without materially affecting the mask pressure when underwater. The baseline SCAOS design uses an 1800 psi emergency oxygen supply (in addition to the bailout supply) to provide oxygen for 30 minutes at 30,000 feet in the event of a total system failure. This volume describes the design, development and testing of a T-39 configurated SCAOS system as modified for Navy use and the design of an emergency supply for 10 minutes operation underwater to a depth of 33 feet. (Modified author abstract) GRA

06 CHEMISTRY

Includes chemical analysis and identification (e.g. spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N74-20787 University of South Florida, Tampa.

SOME STUDIES ON THE DETECTION AND DETERMINATION OF MERCURY, ARSENIC AND ANTIMONY IN GAS DISCHARGES Ph.D. Thesis

Craig Carl Foreback 1973 127 p

Avail: Univ. Microfilms Order No. 74-2371

Methods which are sufficiently sensitive for the detection and determination of specific molecular forms of mercury, arsenic and antimony at the levels found in the environment are discussed. An emission type detection system combined with appropriate chemistry and sample handling has been adapted for the detection and determination of inorganic and biologically methylated types of arsenic, antimony and mercury compounds. Attention is focused on the molecular form of these metals because anerobic bacteria are known to methylate mercury and arsenic producing molecular forms to these elements other than the expected inorganic forms found in nature. Dissert. Abstr.

N74-20788 Texas Univ., Austin.

DIFFUSION AND VISCOSITY OF LIQUID METAL ELEMENTS Ph.D. Thesis

Anthony Loring Hines 1973 186 p

Avail: Univ. Microfilms Order No. 74-5255

A theoretical diffusion equation was developed from principles viz., fluctuation distance, frequency, and probability, based on a new interpretation of the fluctuation distance and the probability. The fluctuation distance is determined from fundamental structural data, and the probability was shown to be the empty volume fraction developed by Walls. This model accurately predicts pure component self-diffusion coefficients in ten liquid metals for which sufficient diffusion and auxiliary data are available to permit a comparison of theory to experimental data. This research also involved the development of improved methods and interpretations for the calculation of viscosities from fundamental structural and energy data. Dissert. Abstr.

N74-20789 National Bureau of Standards, Washington, D.C.

VIBRATIONALLY EXCITED HYDROGEN HALIDES: A BIBLIOGRAPHY ON CHEMICAL KINETICS OF CHEMIEXCITATION AND ENERGY TRANSFER PROCESSES (1958 THROUGH 1973) Interim Report

Francis Westley Apr. 1974 81 p refs Sponsored in part by AFOSR

(NBS-SP-392) Avail: SOD HC $1.30 as C13.10:392

A bibliography is provided for published papers and reports containing rate data for reactions of halogen atoms, with hydrogen containing compounds, or of H (D, or T) atoms with halogen containing compounds to form vibrationally chemiexcited hydrogen halides. The reactions for vibroexcitation, of hydrogen halides through unimolecular or photochemical elimination, as well as the processes for vibrational energy transfer between hydrogen

halides and various second bodies are also included. In addition, four lists of theoretical papers and a list of critical reviews and bibliographies are provided. Over 300 papers covering 50 types of reactions are listed. The period covered extends from 1958 through 1973. Author

N74-20790*# Virginia Commonwealth Univ., Richmond. Dept. of Chemistry.
ISOMER EFFECTS ON POLYIMIDE PROPERTIES Annual Report
B. L. Stump 26 Feb. 1974 23 p refs
(Contract NGR-47-002-041)
(NASA-CR-137413; AR-1) Avail: NTIS HC $4.25 CSCL 07C

The polymerization of 2,4'-methylene-dianiline with benzophenone tetracarboxylic acid dianhydride yields high molecular weight polyamic acid. Polyimide is formed when films of the polyamic acid are cured between 200 - 300 C. A lower molecular weight polyamic acid is obtained from 2,2'-MDA with BTDA, but it appears that a lowering of the reaction temperature will yield high molecular weight polymer. Evaluation of these polymers is underway. Continued efforts to synthesize 2,3'- MDA and 2,3'-diaminobenzophenone have met with little success. Author

N74-20791# Notre Dame Univ., Ind. Radiation Chemistry Data Center.
RADIATION CHEMISTRY OF ETHANOL: A REVIEW OF DATA ON YIELDS, REACTION RATE PARAMETERS, AND SPECTRAL PROPERTIES OF TRANSIENTS
Gordon R. Freeman (Alberta Univ., Edmondton) Washington NBS Feb. 1974 43 p refs Sponsored by NBS and AEC
(NSRDS-NBS-48; LC-73-600192) Avail: SOD HC $0.80 as C13.48:48

The yields (G) for products and intermediates formed by irradiation of ethanol, in the solid, liquid, and gaseous state, were compiled and reviewed. Rates of reactions of transient ions and radicals and spectroscopic parameters, including optical and ESR spectra, are also included. Author

N74-20792# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE POSSIBILITY OF DETERMINING THE REACTION RATE CONSTANT OF HYDROXYL UNDER H2O2 PHOTOLYSIS CONDITIONS
Zh. P. Kachanova and Iu. N. Kozlov [1973] 3 p refs Transl. into ENGLISH from Zh. Fiz. Khim. (Moscow), v. 47, 1973 p 2112-2113
Avail: NTIS HC $4.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The possibility of determining the reaction rate constant of hydroxyl under H2O2 photolysis conditions by a concurrent method is considered. The interaction constants of OH with C2H5OH, H2O2 and ethylene diamintetraacetic acid with different pH were measured. It was shown that the results obtained agree with the data of radiation chemistry measurements. Author

N74-20793*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HIGH-TEMPERATURE MASS SPECTROMETRY - VAPORIZATION OF GROUP 4-B METAL CARBIDES
Carl A. Stearns and Fred J. Kohl Washington Apr. 1974 58 p refs
(NASA-TN-D-7613; E-7510) Avail: NTIS HC $3.75 CSCL 07D

The high temperature vaporization of the metal-carbon systems TiC, ZrC, HfC, and ThC was studied by the Knudsen effusion - mass spectrometric method. For each system the metal dicarbide and tetracarbide molecular species were identified in the gas phase. Relative ion currents of the carbides and metals were measured as a function of temperature. Second- and third-law methods were used to determine enthalpies. Maximum values were established for the dissociation energies of the metal monocarbide molecules TiC, ZrC, HfC, and ThC. Thermodynamic functions used in the calculations are discussed in terms of assumed molecular structures and electronic contributions to the partition functions. The trends shown by the dissociation energies of the carbides of Group 4B are compared with those of neighboring groups and discussed in relation to the corresponding oxides and chemical bonding. The high temperature molecular beam inlet system and double focusing mass spectrometer are described. Author

N74-20794# Naval Ordnance Lab., White Oak, Md.
FIXED AND FLUIDIZED BEDS: AN INTRODUCTION
Barry G. Pallay 4 Dec. 1973 52 p refs
(AD-773740; NOLTR-73-54) Avail: NTIS CSCL 13/9

The report explains what fixed and fluidized beds are, where they are used and some of the basic concepts necessary to understand and in some cases model their operation. It is intended to explain enough about these systems so that their potential usefulness may be appreciated and harnessed, so that current state-of-the-art can be quickly reviewed and so that further interest can be satisfied by the references listed throughout the report. Author (GRA)

N74-20795# Aerospace Corp., El Segundo, Calif.
FORMATION OF ELECTRONICALLY EXCITED CO2(+) IN COLLISIONS OF H(+), H, He(+), AND Ne(+) WITH CO2
Michael J. Haugh (Temple Univ.) and John H. Birely 30 Nov. 1973 31 p refs
(Contract F04701-73-C-0074)
(AD-773310; TR-0074(9270-01)-3; SAMSO-TR-74-9) Avail: NTIS CSCL 07/4

Electronic excitation in collisions of 200 eV - 25 keV H(+), H, He(+), and Ne(+) with CO2 has been investigated under single-collision conditions in an atomic beam experiment. Cross sections, emission spectra, mechanisms, and assignments are discussed. GRA

N74-20796# Purdue Univ., Lafayette, Ind. Protect Squid Headquarters.
RELAXATION RATES FROM TIME OF FLIGHT ANALYSIS OF MOLECULAR BEAMS
Robert J. Gallagher and John B. Fenn Dec. 1973 35 p refs Prepared in cooperation with Yale Univ.
(Contract N00014-67-A-0226-0005; Grant NSF GK-25883; NR Proj. 098-038)
(AD-773479; SQUID-TR-YALE-4PU) Avail: NTIS CSCL 07/4

In the free jet generated when a gas is expanded from a reservoir at stagnation temperature, T(0), and pressure, P(0), into a vacuum chamber, substantial lags can occur in the conversion of internal energy into directed kinetic energy of the expansion. An analytical technique is presented for determining rotational energy relaxation rates from velocity distributions measured on the axis of the free jet at a fixed distance from the sonic throat. The agreement with rates obtained by other methods is good. Some experimental and analytical results for carbon dioxide, oxygen, hydrogen, and methane are presented. Author (GRA)

N74-20797# Cornell Univ., Ithaca, N.Y. Dept. of Chemistry.
CHEMICAL EXCITATION VIA LASER RADIATION: VIBRATION-VIBRATION ENERGY TRANSFER PROCESSES Final Technical Report, 1 Oct. 1970 - 30 Sep. 1973
Simon H. Bauer, Walter J. Quiring, Earl Lory, Melvin I. Buchwald, and Walter Shaub Dec. 1973 132 p refs
(Grants DA-ARO(D)-31-124-71-G33;
DA-ARO(D)-31-124-72-G111; DA Proj. 2O0-61102-B-13B)
(AD-773585; DFT-73; AROD-9393-1-C) Avail: NTIS CSCL 07/4

Two groups of experiments were conducted on augmenting chemical conversions by laser radiation. The stimulated Raman effect was used to obtain substantial populations in the v=1 state in H2/D2 mixtures, and to demonstrate that in such mixtures small amounts of HD were produced. A rudimentary model for atom switching due to vibrational excitation was submitted to computer analysis. The second group of experiments concerned systems in which v-T relaxations were rapid, so that irradiation from a CO2 CW laser produced homogeneous heating. The pyrolysis of ammonia has been successfully completed. (Modified author abstract) GRA

N74-20798# Western Michigan Univ., Kalamazoo. Dept. of Chemistry.
RATES AND MECHANISMS OF REACTION OF FLUORINE CONTAINING ROCKET PROPELLANTS Interim Report, 1 Sep. 1972 - 31 Aug. 1973

Thomas Houser Oct. 1973 17 p refs
(Grant AF-AFOSR-2160-72; AF Proj. 9750)
(AD-774448; AFOSR-74-0137TR) Avail: NTIS CSCL 07/4

The study of the rate of the H2-OF2 reaction was continued using a magnesium reactor. The surface contributions to the rate in this reactor were significantly reduced and were considered insignificant. The order of the fully inhibited reaction was reasonably well established as first for OF2 and zero for H2; the data for the uninhibited reaction was less conclusive. A mechanism was proposed which appeared consistent with both sets of conditions. Author (GRA)

N74-20799# Aerospace Corp., El Segundo, Calif. Aerophysics Lab.
A BRIEF REVIEW OF RATE COEFFICIENTS FOR REACTIONS IN THE D2-F2 CHEMICAL SYSTEM Report for Dec. 1972 - Apr. 1973
Norman Cohen 15 Jan. 1974 32 p refs
(Contract F04701-73-C-0074)
(AD-774566; TR-0074(4530)-9; SAMSO-TR-74-14) Avail: NTIS CSCL 07/4

The chemical and energy transfer reaction involved in the deuterium-fluoride chemical laser system is discussed. Current experimental and theoretical evidence relevant to a selection of the most probable value of rate coefficients is reviewed, and a set of best values is recommended. Author (GRA)

N74-20800# California Univ., Berkeley. Dept. of Chemical Engineering.
EFFECT OF SUBSTRATE SURFACE ROUGHNESS ON THE MORPHOLOGY OF PLASMA-POLYMERIZED ETHYLENE
M. Niinomi, H. Kobayashi, A. T. Bell, and M. Shen 1 Jan. 1974 14 p refs
(Contract N00014-69-A-0200-1053; NR Proj. 356-526)
(AD-774125; TR-8) Avail: NTIS CSCL 07/3

Effects of the surface roughness of substrate material on the morphology of polyethylene film deposited by rf plasma reaction were investigated by replica electron microscopy. Aluminum plates which have various degrees of surface roughness were prepared by electropolishing. Some evidences of a gas-phase-polymerization which was not affected by the substrate morphology were also observed. (Modified author abstract) GRA

N74-20801# Pennsylvania State Univ., University Park. Dept. of Materials Science.
INTERDIFFUSION AND ASSOCIATION PHENOMENA IN THE SYSTEM NiO-Al2O3 Interim Report, Jun. 1972 - Jun. 1973
W. J. Minford and V. S. Stubican 15 Dec. 1973 29 p refs
(Contract N00014-67-A-0385-0011; NR Proj. 032-52523)
(AD-774732; TR-5) Avail: NTIS CSCL 07/4

The rate of formation of $NiAl_2O_4$ by reaction between single crystals of NiO and Al_2O_3 is described. In NiO the behavior of D as a function of concentration supports the Lidiard theory of diffusion by impurity-vacancy pairs. A good fit of the theory to the experimental results was obtained by assuming that aluminum ions diffuse as (AlNiVNi) pairs. The free energy of association for pairs was calculated. The interdiffusion coefficients in the spinel showed a constant small increase with the increase of the aluminum ions dissolved in the spinel. (Modified author abstract) GRA

N74-20802# Hydronautics, Inc., Laurel, Md.
THE INFLUENCE OF THE CHEMICAL NATURE OF POLYMERS ON THEIR DRAG REDUCTION CHARACTERISTICS Technical Report, 1 May 1972 - 30 Sep. 1973
M. A. Frommer, A. Lavy, M. A. Kraus, Daniel H. Fruman, and John E. Santo Jan. 1974 68 p refs
(Contract N00014-72-C-0510; NR Proj. 051-540)
(AD-774752; TR-7213-2) Avail: NTIS CSCL 11/9

The influence of the chemical nature of polymers on their drag reduction characteristics was investigated for four different compounds, two commercially available Polyacrylamide (PAM) Polystyrene sulfonate (PSS) and two laboratory modifications of PAM. The degradation of these polymers under repeated shear was also investigated. It is concluded that, by properly tailoring the structural changes of the polymer molecules, higher drag reductions with less degradation can be obtained. Finally, the results of a screening investigation on the drag-reduction characteristics of starches and starch derivatives are presented. It is concluded that these natural resins do not display drag-reducing properties. Author (GRA)

N74-20803# Bureau of Mines, Bartlesville, Okla. Energy Research Center.
THERMODYNAMIC PROPERTIES OF ORGANIC DERIVATIVES OF THE LIGHTER ELEMENTS AND THERMODYNAMIC PROPERTIES OF FLUIDS Final Technical Summary Report, 1 Mar. - 15 Oct. 1973
Donald R. Douslin, William D. Good, Herman L. Finke, John F. Messerly, and Ann Osborn 15 Oct. 1973 22 p refs
(AFOSR ISSA 73-0002; AF Proj. 9750)
(AD-774455; AFOSR-74-0087TR) Avail: NTIS CSCL 07/4

An investigation of strained small-ring compounds in families of cyclic amines and epoxy butanes was continued. The thermodynamic properties of 1,2-epoxybutane including enthalpy of combustion and formation, low-temperature thermal properties, vapor pressures, enthalpy of vaporization, and the values of enthalpy, entropy, Gibbs energy, and equilibrium constant of formation in the vapor state at 298.15 K are completed; work on trans-2,3-epoxybutane is in progress; and the investigation of cyclopentylamine is about 90 percent completed. Author (GRA)

N74-20804# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
CUMULATIVE IONIZATION AND EXCITATION OF MOLECULAR NITROGEN METASTABLES BY ELECTRON IMPACT Ph.D. Thesis
Peter D. Tannen Dec. 1973 181 p refs
(AD-774446; DS/PH/73-2) Avail: NTIS CSCL 07/4

The purpose of this study was the measurement of electron impact ionization cross sections of metastable-molecules of N2. Cumulative cross sections calculated by classical techniques are more than an order of magnitude smaller than those determined from the electron impact measurements. Delayed emissions from the First and Second Positive Systems of N2 were measured. Experimental design and apparatus are described. Emissions are assigned and discussed. GRA

N74-20805# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MECHANISM OF THE EFFECT OF SOLUTION ANIONS ON THE KINETICS OF METAL DISSOLUTION. THE ROLE OF INTERACTION
Ya. M. Kolotyrkin, Yu. A. Popov, and Yu. V. Alekseev 30 Jan. 1974 15 p refs Transl. into ENGLISH from Elektrokhimiya (Moscow), v. 9, no. 5, 1973 p 624-629
(AD-774407; FTD-HT-23-451-74) Avail: NTIS CSCL 07/4

The participation of anions in metal surface corrosion is analyzed by considering the following three reaction stages: chemisorption of the anion, ionization of the surface complex, and chemical transformation of the surface complex in solution which results in anion regeneration. The dependence of the corrosion current on various parameters is shown, and an example calculation for Ni dissolution in aqueous sulfuric acid is included. G.G.

N74-20806# California Univ., Berkeley. Dept. of Chemical Engineering.
PLASMA POLYMERIZATION OF SATURATED AND UNSATURATED HYDROCARBONS
H. Kobayashi, A. T. Bell, and M. Shen 1 Dec. 1973 41 p refs
(Contract N00014-69-A-0200-1053; NR Proj. 356-526)
(AD-773976; TR-7) Avail: NTIS CSCL 07/5

A series of nine saturated and unsaturated hydrocarbons were polymerized by subjecting them to a radio frequency glow discharge at reduced pressures. It was found that acetylene polymerizes most rapidly, followed by ethylene and butadiene, then by propylene, cis-2-butene and isobutylene. The saturated alkanes: methane, ethane, and propane polymerize most slowly. Infrared spectra of the polymers made of ethane ethylene, and acetylene showed that with increasing monomer unsaturation the polymer contained more double bonds, fewer methylene

groups, and a greater tendency to be oxidized after preparation. An examination of the mechanism of ethylene polymerization led to the conclusion that a significant amount of oligomerization occurs in the gas phase. In addition it is hypothesized that an important initial step is the partial conversion of ethylene to acetylene. (Modified author abstract) GRA

N74-20807# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
HETEROCYCLIC POLYMERS DERIVED FROM 1,2,4,5-NAPHTHALENE TETRACARBOXYLIC ACID DIANHYDRIDE Summary Report, Jan. - Jul. 1972
G. A. Loughran and F. E. Arnold Nov. 1973 38 p refs
(AF Proj. 7340)
(AD-774746; AFML-TR-73-221) Avail: NTIS CSCL 07/3

Polycondensation of 3,3,-diaminobenzidine and 1,2,4,5-naphthalenetetracarboxylic acid dianhydride in aprotic solvents at 80C to 120C gave soluble low molecular weight polymers. Increasing the reaction temperature to 160 led to further condensation and gave increasing amounts of insoluble cross-linked material. Some higher molecular weight solid polymer was obtained when m-cresol was used as solvent. The low molecular weight polymers could be further condensed and chain extended with about a twofold increase in molecular weight by heating at 250 C/0.1 mm. However, linear polymers which had been prepared in aprotic solvents up to 80C, on second staging gave 33% to 39% of insoluble cross-linked material. This is believed to be due to a branching reaction taking place between 80C and 120C at the ortho anhydride linkage. Author (GRA)

N74-20808# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
AUTOMATED ESTIMATION OF KINETIC RATE PARAMETERS AND MECHANISMS OF GAS PHASE CHEMICAL REACTIONS Final Report, 1 May - 1 Nov. 1973
Maria Ramos Martinez, Donald J. Miller, and Ronald L. Thommarson Jan. 1974 313 p refs
(Contract DAAD05-73-C-0503)
(AD-774304; MDC-G5012; BRL-CR-135) Avail: NTIS CSCL 07/4

Automated computational techniques were developed and used to evaluate the specific kinetic properties of molecules and to define chemically reacting systems. The Arrhenius rate parameters were calculated for over 100 simple fission, atom transfer, and hot molecule reactions. These data have been used to model the thermal decomposition complex gas phase reactions of organic molecules. As many as 30 elementary reactions were used in the reaction simulation analyses. Concentration/rate time histories were computed for each species represented in the mechanism scheme. The effective rate coefficients and kinetic order of some of the reactions were also determined from the basic data. The data are interpreted and correlated in some detail with experimental findings.
Author (GRA)

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N74-20809* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
PULSE CODE MODULATED SIGNAL SYNCHRONIZER Patent
Herbert S. Kobayashi, inventor (to NASA) Issued 26 Mar. 1974 11 p Filed 24 Jul. 1972 Supersedes N72-28165 (10 - 19, p 2526)
(NASA-Case-MSC-12462-1; US-Patent-3,800,227;
US-Patent-Appl-SN-274360; US-Patent-Class-325-320;
US-Patent-Class-325-423; US-Patent-Class-178-88) Avail: US Patent Office CSCL 17B

A bit synchronizer for a split phase PCM transmission is reported that includes three loop circuits which receive incoming phase coded PCM signals. In the first loop, called a Q-loop, a generated, phase coded, PCM signal is multiplied with the incoming signals, and the frequency and phase of the generated signal are nulled to that of the incoming subcarrier signal. In the second loop, called a B-loop, a circuit multiplies a generated signal with incoming signals to null the phase of the generated signal in a bit phase locked relationship to the incoming signal. In a third loop, called the I-loop, a phase coded PCM signal is multiplied with the incoming signals for decoding the bit information from the PCM signal. A counter means is used for timing of the generated signals and timing of sample intervals for each bit period. Official Gazette of the U.S. Patent Office

N74-20810* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
PULSE CODE MODULATED SIGNAL SYNCHRONIZER Patent
Herbert S. Kobayashi, inventor (to NASA) Issued 23 Apr. 1974 11 p Filed 8 Nov. 1972 Supersedes N73-11142 (11 - 02, p 0141)
(NASA-Case-MSC-12494-1; US-Patent-3,806,816;
US-Patent-Appl-SN-304705; US-Patent-Class-325-321;
US-Patent-Class-325-419) Avail: US Patent Office CSCL 09E

A bit synchronizer for a split phase PCM transmission has first and second loop systems which respectively receive incoming phase coded PCM signals. In the first loop system the incoming bit signals are simultaneously supplied to two channels which alternately receive a generated, phase coded bit signal representative of a binary digit, and the generated bit signal is multiplied with the incoming bit signals. The multiplied signals are respectively integrated and held. When the incoming signal is properly phase locked with the generated bit signal, each channel will produce an integrated value which increases (either positively or negatively) over the entire bit period of the generated bit signal. The channels are respectively sampled at the end of one bit period and at the beginning of the following bit period. The sampled signals are supplied to a bit lock detector.
Official Gazette of the U.S. Patent Office

N74-20811* National Aeronautics and Space Administration. Pasadena Office, Calif.
DECISION FEEDBACK LOOP FOR TRACKING A POLY-PHASE MODULATED CARRIER Patent
Marvin K. Simon, inventor (to NASA) (JPL) Issued 23 Apr. 1974 8 p Filed 6 Mar. 1973 Supersedes N73-20180 (11 - 11, p 1255) Sponsored by NASA
(NASA-Case-NPO-13103-1; US-Patent-3,806,815;
US-Patent-Appl-SN-338484; US-Patent-Class-325-320;
US-Patent-Class-329-122; US-Patent-Class-325-419) Avail: US Patent Office CSCL 17B

A multiple phase modulated carrier tracking loop for use in a frequency shift keying system is described in which carrier tracking efficiency is improved by making use of the decision signals made on the data phase transmitted in each T-second interval. The decision signal is used to produce a pair of decision-feedback quadrature signals for enhancing the loop's performance in developing a loop phase error signal.
Official Gazette of the U.S. Patent Office

N74-20812 Stanford Univ., Calif.
LUNAR RADAR ECHOES: AN INTERPRETATION EMPHASIZING CHARACTERISTICS OF THE LEADING EDGE Ph.D. Thesis
Richard Allan Simpson 1973 236 p
Avail: Univ. Microfilms Order No. 74-6551

Homogeneity of the lunar surface and its radio wave scattering properties have been assumed in most analyses of radar echoes backscattered by the moon to earth. Recent data obtained using forward scatter from transmitters aboard lunar-orbiting spacecraft have required use of a heterogeneous model for interpretation. New backscatter results at 1290 MHz using 13 micron sec pulses indicate that variations of the radar echo can be detected as a function of the location of the subradar point and imply that the heterogeneous model should be considered in all cases. Observations taken when the subradar point was in three widely separated locations produced distinct power vs time echo curves. Although codification of existing physical- and geometrical-

optics models has simplified analysis, the three data sets are found to agree best with three different scattering laws.
Dissert. Abstr.

N74-20813* National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
ROTATING RASTER GENERATOR Patent
Charles A. Wagner, inventor (to NASA) Issued 9 Apr. 1974 12 p Filed 17 Nov. 1972 Supersedes N73-14171 (11 - 05, p 0513)
(NASA-Case-FRC-10071-1; US-Patent-3,803,445; US-Patent-Appl-SN-307727; US-Patent-Class-315-18; US-Patent-Class-315-22; US-Patent-Class-178-7.7) Avail: US Patent Office CSCL 17B

A rotating raster generator is provided which enables display of a television raster at any arbitrary roll angle. The generator includes four integrator circuits each of which receives a first voltage input corresponding to the sine or cosine of the desired roll angle and a second input comprising conventional horizontal or vertical sync pulses. The integrator circuits each comprise an operational amplifier and a capacitor connected for producing a ramp output having a rate of change proportional to the roll angle input, an electronic switch responsive to the sync input for resetting the integrator, and a summer that adds the ramp output of the integrator to the roll angle input so as to provide a zero-centered deflection control voltage.
Official Gazette of the U.S. Patent Office

N74-20814 Wisconsin Univ., Madison.
ERROR PROBABILITY PREDICTIONS FOR A DIGITAL TROPOSCATTER SYSTEM USING ESTIMATES OF THE CHANNEL IMPULSE RESPONSE Ph.D. Thesis
Steven Alfred Gronemeyer 1973 125 p
Avail: Univ. Microfilms Order No. 73-27102

Radar estimates of the time varying impulse response of a tropospheric scatter channel are used to estimate the error rates for an incoherent binary frequency shift keying system utilizing post detection diversity combining. Methods of computing error rates for such systems are available in the literature. The analysis allows for a continuous variation of channel gain and interference between any number of signaling band intervals. Estimates of the troposcatter channel impulse response are obtained through the use of a Rake channel probing forward scatter radar. The Rake equipment utilizes a long pseudo-random code and a multi-correlator receiver to resolve the multipath structure of the channel. At high data rates, the frequency selective fading phenomenon dominates the production of errors. Dissert. Abstr.

N74-20815*# Stanford Univ., Calif. Inst. for Plasma Research.
THE RELATIONSHIP BETWEEN THE SLOWLY VARYING COMPONENT OF SOLAR RADIO EMISSION AND LARGE SCALE PHOTOSPHERIC MAGNETIC FIELD PATTERNS
P. H. Scherrer and M. El-Raey (Calif. Univ., Berkeley) Dec. 1973 17 p refs
(Grants NGR-05-020-559; NGR-05-003-497; Contract N00014-67-A-0112-0068; Grant NSF GA-31138)
(NASA-CR-137405; SU-IPR-556) Avail: NTIS HC $4.00 CSCL 03B

Daily solar radio flux observations have been examined for a relationship to the large-scale photospheric magnetic field structure. Interplanetary magnetic field sector boundaries were used to indicate boundaries between photospheric field regions of opposite polarity. An enhancement in emission was found about four days before the boundary central meridian passage. Most of the effect came from emission near toward-to-away type boundaries. A higher level of emission appears to be associated with toward field regions than with away field regions.
Author

N74-20816*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ANALYSIS OF FINITE-SIZE PHASED ARRAYS OF CIRCULAR WAVEGUIDE ELEMENTS Ph.D. Thesis - Va. Polytech. Inst. and State Univ.
M. C. Bailey Washington Apr. 1974 128 p refs
(NASA-TR-R-408; L-8919) Avail: NTIS HC $4.75 CSCL 17B

A derivation is presented for the calculation of the interelement mutual coupling in a finite-size planar array of waveguide-fed apertures covered by a multilayered dielectric and/or plasma. The general mutual admittance expression is evaluated for circular apertures and the mutual coupling calculations are verified experimentally for two transverse electric circular waveguide mode excited apertures. A parametric study of higher order mode aperture fields indicates that the only significant change in the circular aperture mutual coupling is due to the transverse magnetic mode, which introduces an additional phase shift. Qualitative agreement between calculations for a 183-element array of circular apertures and an infinite array establishes the validity of the finite-array theoretical model.
Author

N74-20817# Laboratoire Central de Telecommunications, Paris (France).
S-BAND TELEMETRY TRANSMITTER [EMETTEUR DE TELEMESURE EN BANDE S]
N. J. DHollander Paris ESRO Jan. 1974 121 p Partly in FRENCH and partly in ENGLISH; ENGLISH summary
(Contract ESTEC-1740/72)
(ESRO-CR-218) Avail: NTIS HC $9.25

The development of a modular S-band telemetry transmitter up to complete qualification is described. The following modifications to a model were made: addition of an auxiliary input and p-i-n diode commutator enabling the transmitter to work either autonomously or as an integral part of a coherent transponder; modification of the multiplication factor so that certain requirements of the GRARR systems could be met, improvement of the performance of the power stage by employing a 4 GHz transistor and an output circuit. The telemetry transmitter successfully passed a series of tests leading to complete qualification. Studies have shown that it is possible to produce space-qualified transmitters that can be integrated into coherent transponders and can supply power between 0.5 and 6W at S-band frequencies.
ESRO

N74-20818# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
THE POLARIZATION LOSSES OF OFFSET PARABOLOID ANTENNAS
J. Dijk, C. T. W. VanDiepenbeek (Max-Planck-Inst. fuer Astronomie), E. J. Maanders, and L. F. G. Thurlings Jun. 1973 52 p refs
(TH-73-E-39; ISBN-90-6144-039-4) Avail: NTIS HC $5.75

The electric field in the aperture of offset front-fed paraboloid antennas and open Cassegrain antennas, excited by an electric dipole or Huygens source in the focus, was compared with the fields of front-fed circularly symmetrical paraboloid reflector antennas and classical Cassegrain antennas. The aperture field forms the basis of expressions to calculate the polarization efficiency of all four types of antenna. Computed results are given, showing that offset antennas can compete with front-fed paraboloids if they are excited by an electric dipole; the classical Cassegrain antenna, however, show better results. If offset antennas are excited by a Huygens source, they are very unfavorable compared with the symmetrical antennas, which show no cross-polarization.
Author (ESRO)

N74-20819# European Space Research Organization, Paris (France).
POSSIBILITIES OF AN AIRBORNE TELEVISION SYSTEM
Armin Quast Feb. 1974 28 p refs Transl. into ENGLISH of "Moeglichkeiten eines Flugzeug-Fernseh-Systems", DFVLR, Inst. fuer Aerodyn., Brunswick, report DLR-MITT-73-09, 1973
(ESRO-TT-20; DLR-MITT-73-09) Avail: NTIS HC $4.50; DFVLR Porz-Wahn: 8.50 DM

At present television is transmitted nearly exclusively via ground stations and for the future transmission by satellite is taken into consideration. An airborne television system is considered, which has remarkable technical and economical advantages. It is shown that two aircraft circulating at an altitude of 20 km can replace the whole ground system of an area with the dimension of the Federal Republic of Germany. The airborne television system can be realized without technical risks and at relatively low cost. The aircraft itself can be used for numerous future tasks.
Author (ESRO)

N74-20820# European Space Research Organization, Paris (France).
CALCULATION OF INTERFERENCES OF THE HELIOS LOW-GAIN ANTENNA
Nikolaus Stavropoulos Feb. 1974 72 p refs Transl. into ENGLISH of Berechnung der Interferenzen der Helios-low gain antenne, DLR-FB-73-47, DFVLR, 1973
(ESRO-TT-27; DLR-FB-73-47) Avail: NTIS HC $6.75

The quasiisotropic radiation patterns of the low gain antenna of the solar probe Helios are composed of the vertically polarized radiation of a biconical dipole and the elliptically to approximately circularly polarized radiation of a conical horn. The elliptical or circular polarization is obtained by a helix in a cylindrical waveguide connected to a conical horn. The distance horn (dipole on the spin axis of the solar probe) equals roughly 31 wavelengths and the eccentricity of the horn to the spin axis is approximately 6 wavelengths at 2.3 GHz. The measured dipole and horn fields are approximated by mathematical equations and the resulting vertical field is calculated by vectorial addition of the electrical vectors. The mathematical result corresponds well with the measured interferences of both fields. Author (ESRO)

N74-20821# Lincoln Lab., Mass. Inst. of Tech., Lexington.
AZIMUTH - ELEVATION ESTIMATION PERFORMANCE OF A SPATIALLY DISPERSIVE CHANNEL
T. P. McCarty 18 Dec. 1973 69 p refs
(Contract DOT-FA72WAI-261)
(AD-773426; TN-1973-44; ESD-TR-73-344) Avail: NTIS CSCL 17/1

A model is presented for the estimation of azimuth and elevation in a dispersive media where the signals come from a continuum of directions. These bounds depend upon the array ambiguity patterns and the channel spread function. Specific cases are discussed showing how the result reduces to an easily tractable analytical tool in many cases of interest. The model discussed is applicable to angular estimation performance in the presence of such interference as diffuse multipath, chaff clouds, vertical angle of arrival spread in sonar systems and turbulent and multiple scattered optical channels. Author (GRA)

N74-20822# Scientific Research Associates, Inc., Rockville, Md.
EXTENSION OF CIRCLE DIAGRAM TECHNIQUES TO PROPAGATION IN STRATIFIED FLUIDS
Albert A. Hudimac 1 Dec. 1973 49 p refs
(Contract N00014-70-C-0378)
(AD-773519; Rept-73-1) Avail: NTIS CSCL 20/14

The circle diagram technique from transmission line theory is applied and extended to enable the graphical solution of types of transmission line problems that occur in the analysis of propagation in stratified fluids. The normalized impedance satisfies a generalized Riccati equation, but the analysis is approximated by a graphical solution for a line with a step-wise varying wave number. Another modification has been made for cases of imaginary wave number, i. e. an overdense medium. For infinite domains, a graphical solution has been matched to an asymptotic approximation. Techniques are developed for obtaining approximations of transmission through and reflections from stratified layers, eigenfunctions and eigenvalues, and Green's functions. Author (GRA)

N74-20823# Naval Research Lab., Washington, D.C.
A FIVE-CHANNEL (2-kW-PEP) 2 TO 30 MHz DISTRIBUTION SYSTEM
Harold D. Murray, Denis Q. Arnesen, and Charles E. Hobbis 21 Dec. 1973 47 p
(AD-773476; NRL-7659) Avail: NTIS CSCL 17/2

The concept of a radio-frequency distribution system customized to the special requirements and constraints of ships having five transmitters or less was investigated. The analysis, experimental design, and measurements of the performance of an experimental model of one channel of the system was successfully completed. When fully implemented the system will provide for the simultaneous operation of five transmitters in the 2 to 30 MHz frequency range into two broadband antennas in a single systems package. A program should be initiated to develop a complete self-contained selective distribution system as an engineering model of the system whose design was proven by the present investigation. Author (GRA)

N74-20824# Florida Univ., Gainesville. Engineering and Industrial Experiment Station.
RANGE LAWS FOR FM RADARS WITH HARMONIC PROCESSING AND ARBITRARY MODULATING WAVESHAPES
Leon W. Couch and Raymond C. Johnson 14 Nov. 1973 44 p refs
(Contract DAAG39-73-C-0169)
(AD-773713; HDL-0169-1) Avail: NTIS CSCL 17/9

The range response of a periodically modulated FM radar is derived for some useful harmonic processing systems in terms of Fourier coefficients which are identical to points on the ambiguity function. The Fourier coefficients are evaluated for a piecewise-linear modulation waveform which may be used to approximate an arbitrary modulating waveshape. Thus, the approximate range response of an arbitrary modulation waveform is obtained. Range laws for incoherent, coherent and directional doppler detection are obtained by vector addition of the properly weighted complex Fourier coefficients. For coherent harmonic processing using an arbitrary periodic waveform for the reference, the phasing of the reference waveform is shown to be of importance in cancelling undesired range sidelobes. (Modified author abstract) GRA

N74-20825# Army Electronics Command, Fort Monmouth, N.J.
BROADBAND UHF ISOLATOR
Elmer Freibergs Dec. 1973 19 p refs
(DA Proj. 1S7-62705-A-057)
(AD-773906; ECOM-4168) Avail: NTIS CSCL 09/1

A design technique is described which employs lumped element reactances in combination with a lumped element circulator to achieve wide band isolator characteristics. Reactive elements, such as capacitors, have been placed into the circuit in such a way as to maintain the relative relationships between the positive and negative circularly polarized waves essential for nonreciprocity over a wide band of frequencies. Isolation above 15 db with one db insertion loss has been obtained from 245 to 350 MHz, while isolation above 20 db, is maintained from 240 to 400 MHz with insertion loss rising linearly with frequency to a maximum of about 2.5 db at 400 MHz. Author (GRA)

N74-20826# Banaras Hindu Univ., Varanasi (India). Inst. of Tech.
ELECTROMAGNETIC WAVE PROPAGATION AND RADIATION THROUGH PLASMAS
Rama Nohar Singh Sep. 1973 143 p refs
(Grant EOOAR-70-0070; AF Proj. 5631)
(AD-774639; AFCRL-TR-74-0078; SR-5) Avail: NTIS CSCL 20/14

The report includes the study of electromagnetic wave propagation and radiation through plasmas. The transient response of short duration electromagnetic pulses has been studied in order to investigate certain properties of the reflecting layers. The study of transient electromagnetic wave propagation was extended to investigate certain properties of laboratory plasma. It is argued and shown that such a study could be of great diagnostic value. Further, in the third section of this report the radiation properties of antennas immersed in plasmas have been studied and their diagnostic features have been shown. With a view to show the superiority of helical antenna over other antennas used in satellites a study was carried out and is included in section four. The polarization features and modes of radiation of helix make its use very handy in satellite transmission. Certain studies regarding the range determination accounting for the effect of plasma scattering was carried out and is included in fifth section of this report. Author (GRA)

N74-20827# Cornell Univ., Ithaca, N.Y.
ANALYSIS AND DIGITAL HARDWARE REALIZATION OF NON-GAUSSIAN IMPULSE NOISE IN WIDEBAND COMMUNICATIONS SYSTEMS
Walter H. Ku and Yrjo Neuvo Oct. 1973 65 p refs
(Contract F30602-72-C-0497; AF Proj. 9567)
(AD-774443; RADC-TR-73-311) Avail: NTIS CSCL 17/2

The report presents results on the analysis and digital hardware realization of a non-Gaussian impulse noise source which can be used to model the impulsive noise present in wideband communications systems. The impulsive noise appearing on practical systems is characterized by bursts of much higher amplitudes than would be predicted by a normal- or Gaussian-distribution law. The impulse noise model and the actual hardware noise generator described in this paper are capable of producing Gaussian background noise, lognormal impulsive noise, and burst timing to set prescribed starting and ending times of the bursts and impulse density within each of the burst periods. The techniques used in this paper are based on first generating a basic Pseudo Random Binary Sequence (PRBS) generator and, from this, deriving the Gaussian background noise by adding samples from the PRBS generator. (Modified author abstract) GRA

N74-20828# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
DEMONSTRATION OF TRANSVERSE ELECTRIC (TE) MODE RADIO PROPAGATION IN THE EARTH-IONOSPHERE WAVEGUIDE
Robert P. Harrison 24 Jan. 1974 31 p Presented at Sci. and Eng. Symp., Albuquerque, N. Mex.
(AF Proj. 4603)
(AD-774449; AFCRL-TR-74-0045) Avail: NTIS CSCL 17/2

An investigation was made of the use of Transverse Electric (TE) Modes of propagation rather than the conventional Transverse Magnetic (TM) Modes at Very Low Frequencies. Theoretical comparisons show that TE waves should propagate better then TM waves in the earth-ionosphere waveguide under both normal and disturbed ionospheric conditions. Electromagnetic boundary conditions at the surface of the earth prevent efficient excitation and reception of radio waves generated in the TE Mode, but at higher altitudes, air-to-air communications is a practical reality. (Modified author abstract) GRA

N74-20829# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Operations Research.
OPTIMAL DESIGN OF ACOUSTIC SONAR TRANSDUCER ARRAYS
Leon S. Lasdon, Allan D. Waren, and Dan Suchman Nov. 1973 30 p refs
(Contract N00014-67-A-0404-0010)
(AD-774724; TM-326) Avail: NTIS CSCL 17/1

A problem in engineering design is formulated and solved as a nonlinear optimization problem. The problem is to design an array of sonar acoustic transducers. Design parameters are the locations of the transducers, their amplitude shading coefficients and phase delays. The objective is to choose values for these parameters so that the directivity pattern of the array has a narrow main lobe and minimal minor lobe levels. The problem is solved by an interior penalty function method. Results are presented which show significant improvement of the directivity pattern for two test problems. A final section discusses the effects varying the frequency of the incoming signal, and of steering the array. Author (GRA)

N74-20830# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
QUALIFICATION TESTING OF MICROCOM CORPORATION BEACON TRANSMITTER TYPE XB-12 Final Report
J. Ozer 18 Jan. 1974 10 p refs
(AD-774709; NADC-73209-30) Avail: NTIS CSCL 17/7

The report covers the qualification tests of a radio frequency beacon intended for use in identifying and/or locating a recoverable aerial target. Failures experienced in testing to specifications are reported. Subsequent correction of deficiencies and retesting produced satisfactory results. The beacon is considered qualified for service use. Author (GRA)

N74-20831# Aerospace Corp., El Segundo, Calif.
A BRANCHING ALGORITHM FOR DISCRIMINATING AND TRACKING MULTIPLE OBJECTS
P. Smith and G. Buechler 1 Oct. 1973 31 p refs
(Contract F04701-73-C-0074)
(AD-774096; TR-0074(4143)-2; SAMSO-TR-74-12) Avail: NTIS CSCL 17/9

A recursive branching algorithm for a large class of multiple-object discrimination and tracking problems is described. The algorithm is an approximation of the optimal unbounded tree-branching solution provided by optimal adaptive filtering theory. The algorithm consists of a bank of parallel filters of the Kalman form, each of which estimates a trajectory associated with a certain selected measurement sequence. The measurement sequences processed by the algorithm are restricted to a tractable number of combining similar trajectory estimates, by passing over unlikely measurement-state associations, and by dropping unlikely trajectory estimates. This branch editing is accomplished by various threshold tests based on the innovations sequence and state estimate of each filter. The numerical experiments performed using the algorithm demonstrate the feasibility of tracking several objects against a noisy background. Two background noise density parameters and two ratio parameters analogous to the classical signal-to-noise ratio are defined. Author (GRA)

N74-20832# Naval Weapons Center, China Lake, Calif.
A PRACTICAL APPROACH TO THE ANALYSIS AND DESIGN OF ZERO VELOCITY ERROR RANGE TRACKERS Technical Publication
Richard Smith Hughes Dec. 1973 47 p refs
(AD-774696; NWC-TP-5566) Avail: NTIS CSCL 17/9

Zero velocity error analog range tracking loops have been in wide use in radar signal processors for many years. However, a general design procedure for calculating the pertinent component values to fulfill a given requirement is apparently nonexistent. The report is intended to fill this void and provide the designer with a practical approach to the design of pertinent component values for second-order, type 2 range tracking integrators. Methods of target thresholding, acquisition, and reacquisition are not discussed. Author (GRA)

N74-20833# California Inst. of Tech., Pasadena. Antenna Lab.
PROPAGATION IN VARYING MEDIA
Giorgio Franceschetti Dec. 1973 28 p
(Grant AF-AFOSR-1935-70; AF Proj. 9768)
(AD-774120; TR-69; AFOSR-74-0089TR) Avail: NTIS CSCL 20/14

The similarity between propagation in space-varying and in time-varying media is exploited, making recourse to Fourier transformation in the frequency and wavenumber space respectively. The use of a Riccati equation for studying these problems is shown. Application is made to the case of a cold isotropic plasma, with an exponential space or time transition. Author (GRA)

N74-20834# Naval Research Lab., Washington, D.C.
GAIN ADJUSTMENT OF AN ALPHA-BETA FILTER WITH RANDOM UPDATES Interim Report
Ben H. Cantrell 21 Dec. 1973 19 p refs
(AD-774087; NRL-7647) Avail: NTIS CSCL 17/9

A procedure for adjusting the gains in an alpha-beta filter used in tracking air targets by search radars is given for the case in which the track updates appear randomly in time. (Modified author abstract) GRA

N74-21446* Nagoya Univ. (Japan). Research Inst. of Atmospherics.
STRUCTURE OF PROTON CENTERS AND ASSOCIATED NONTHERMAL BURSTS AT MICROWAVE FREQUENCIES
Shinzo Enome and Haruo Tanaka *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 78-86 refs (For availability see N74-21440 12-30)
CSCL 03B

N74-21447* Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
SPECTRAL CHARACTERISTICS OF MICROWAVE BURSTS
Donald A. Guidice and John P. Castelli *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 87-103 refs (For availability see N74-21440 12-30)
CSCL 03B

N74-21448* Maryland Univ., College Park. Astronomy Program.
MILLIMETER WAVELENGTH OBSERVATIONS OF SOLAR ACTIVE REGIONS
M. R. Kundu *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 104-113 refs (For availability see N74-21440 12-30)
CSCL 03B

N74-21449* Radio and Space Research Station, Slough (England).
SOLAR MILLIMETER BURSTS
David L. Croom *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 114-123 refs (For availability see N74-21440 12-30)
CSCL 03B

N74-21478* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR RADIO BURSTS AT KILOMETER WAVELENGTHS
R. G. Stone and Joseph Fainberg *In its* High Energy Phenomena on the Sun 1973 p 519-536 refs (For availability see N74-21440 12-30)
CSCL 03B

N74-21486* Los Alamos Scientific Lab., N.Mex.
THE POSITION AND SIZE OF RADIO SOURCES ASSOCIATED WITH SOLAR ELECTRON EVENTS
I. D. Palmer and R. P. Lin (Calif. Univ., Berkeley) *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 594-601 refs Sponsored in part by AEC (For availability see N74-21440 12-30)
(Grant NGL-05-003-017)
CSCL 03B

N74-21487* Observatoire de Paris-Meudon (France).
HIGH SENSITIVITY SPECTRAL OBSERVATIONS IN THE DECAMETRIC RANGE
Jerome DeLaNoe, Andre Boischot, and Monique Aubier *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 602-609 refs (For availability see N74-21440 12-30)
CSCL 03B

N74-21488* Observatoire de Paris-Meudon (France).
A HIGH RESOLUTION STUDY IN TIME, POSITION, INTENSITY, AND FREQUENCY OF A RADIO EVENT ON 14 JANUARY 1971
C. Caroubalos, M. Pick (Sterrewacht Sonnenborgh, Utrecht), H. Rosenberg, and C. Slottje *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 610-614 refs (For availability see N74-21440 12-30)
CSCL 03B

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

N74-20835 Southern Methodist Univ., Dallas, Tex.
DERIVATION OF NEAR MINIMAL TEST SETS AND FAULT PARTITIONING TECHNIQUES Ph.D. Thesis
Ravi Marutirao Apte 1973 176 p
Avail: Univ. Microfilms Order No. 74-5164

Generation of near minimal test sets for total stuck-at-fault-detection in a digital network is described, and fault detection verification with respect to time, using improved fault simulation techniques are outlined. Algorithms are developed to generate a near minimal test set for combinational networks. These are applicable to large networks (depending on available primary storage) in 'incore' fashion. These algorithms use a path covering technique in conjunction with single dimensional path sensitization, and are extended to handle sequential networks on a heuristic basis. Dissert. Abstr.

N74-20836* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A SYNCHRONOUS BINARY ARRAY DIVIDER Patent
Gary Y. Wang, inventor (to NASA) Issued 3 May 1974 8 p Filed 1 Jul. 1969 Supersedes N70-11132 (08 - 01, p 0063) (NASA-Case-ERC-10180-1; US-Patent-3,803,393; US-Patent-Appl-SN-838278; US-Patent-Class-235-164) Avail: US Patent Office CSCL 09B

An asynchronous binary divider formed of an array of identical logic cells is described. Each cell includes a single bit binary subtractor and a selection gate. The array is connected to divisor, dividend, quotient and remainder registers. Divisor and dividend numbers are read into the divisor and dividend registers, respectively. The array of identical logic cells performs the division in parallel asynchronously and places the results of the division in the quotient and remainder registers for subsequent readout. Official Gazette of the U.S. Patent Office

N74-20837 Purdue Univ., Lafayette, Ind.
ERROR ESTIMATION AND ITS APPLICATION TO FEATURE EXTRACTION IN PATTERN RECOGNITION Ph.D. Thesis
Tsvi Lissack 1973 166 p
Avail: Univ. Microfilms Order No. 74-5001

In many problems of pattern recognition and communication, the main concern is to find features or signals which will optimize a certain separability criterion. Observing that the best known error bound coincides with J2 (alpha = 2) and is equal to the asymptotic performance of the first nearest neighbor classifier, it is concluded that all these other measures are seldom useful, except for simple restricted cases. Direct estimation of the error using the proposed separability measure with alpha = 1 is discussed for parametric and non-parametric cases. These error estimation schemes are then called in general, the F-method. It was found that the estimation of the error requires less computation than some of the common separability measures. The error estimated by the F-method is found superior to all other methods, even to those methods that were specially designed for some restricted problems. Dissert. Abstr.

N74-20838 University of Southern Calif., Los Angeles.
SOME PROPERTIES OF STRING TRANSDUCERS Ph.D. Thesis
Russell Joseph Abbott 1973 82 p
Avail: Univ. Microfilms Order No. 74-5845

A transducer is an automaton which transforms an input string into an output string, where both the input and output strings consist of symbols from some finite alphabet of symbols. A transducer performs its computations on a working tape of discrete squares. Each square may contain one symbol from a finite working alphabet. A transducer M is said to be a member of the class M(L(n)) of L(n) space bounded transducers, if, whenever M completes a computation on an input of length n, then M makes use of no more than L(n) squares of working tape. It is shown that the class M(log(n)) is closed under finite composition. A multi-pass transducer is the composition of a transducer with itself some number of times. A multi-pass transducer M is called P(n) pass bounded if, whenever M halts on an input of length n, then M makes no more than P(n) passes on the input. The class of transducers which are both P(n) pass bounded as well as L(n) space bounded is designated M(P(n), L(n)). Dissert. Abstr.

N74-20839*# Intermetrics, Inc., Cambridge, Mass.
SUMC/MPOS/HAL INTERFACE STUDY Final Report
Joseph A. Saponaro and Alex L. Kosmala Dec. 1973 86 p refs
(Contract NAS8-29607)
(NASA-CR-120182) Avail: NTIS HC $7.50 CSCL 09B

The implementation of the HAL/S language on the IBM-360, and in particular the mechanization of its real time, I/O, and error control statements within the OS-360 environment is described. The objectives are twofold: (1) An analysis and general description of HAL/S real time, I/O, and error control statements and the structure required to mechanize these statements. The emphasis is on describing the logical functions performed upon execution of each HAL statement rather than defining whether it is accomplished by the compiler or operating system. (2) An identification of the OS-360 facilities required during execution

of HAL/S code as implemented for the current HAL/S-360 compiler; and an evaluation of the aspects involved with interfacing HAL/S with the SUMC operating system utilizing either the HAL/S-360 compiler or by designing a new HAL/S-SUMC compiler. Author

N74-20840*# Hughes Aircraft Co., Fullerton, Calif.
DESIGN OF A MODULAR DIGITAL COMPUTER SYSTEM DRL 4 AND 5 Final and Phase 3 Report
21 Dec. 1973 260 p refs
(Contract NAS8-27926)
(NASA-CR-120204; FR-73-11-998) Avail: NTIS HC $16.00 CSCL 09B

Design and development efforts for a spaceborne modular computer system are reported. An initial baseline description is followed by an interface design that includes definition of the overall system response to all classes of failure. Final versions for the register level designs for all module types were completed. Packaging, support and control executive software, including memory utilization estimates and design verification plan, were formalized to insure a soundly integrated design of the digital computer system. G.G.

N74-20841*# Radiation, Inc., Melbourne, Fla. Electro-Optics Operation.
UPDATED OPTICAL READ/WRITE MEMORY SYSTEM COMPONENTS Quarterly Progress Report, 1 Nov. 1973 - 31 Jan. 1974
Feb. 1974 30 p refs
(Contract NAS8-26672)
(NASA-CR-120197; QPR-2; Rept-6320-Q-2) Avail: NTIS HC $4.50 CSCL 09B

A survey of the building blocks of the electro-optic read/write system was made. Critical areas and alternate paths are discussed. The latest PLZT block data composer is analyzed. Stricter controls in the production and fabrication of PLZT are implied by the performance of the BDC. A reverse charge before erase has eliminated several problems observed in the parallel plane charging process for photoconductor-thermoplastic hologram storage. Author

N74-20842# National Bureau of Standards, Washington, D.C. Systems and Software Div.
A TECHNICAL INDEX OF INTERACTIVE INFORMATION SYSTEMS
Dennis W. Fife, Kirk Rankin, Elizabeth Fong, Justin C. Walker, and Beatrice A. Marron Mar. 1974 73 p refs Sponsored by NSF
(NBS-TN-819) Avail: SOD HC $1.20 as C13.46:819 CSCL 09B

A reference is presented to technical features and operational status of interactive information systems, providing a 'conversational' usage mode to a 'non-programmer' through a data terminal device. It is aimed at the ADP service manager, for his use in the state-of-the-art assessments preparatory to a detailed system selection process. The index describes 46 systems in terms of a list of over 50 technical features plus descriptive, identification, and background information. In addition, there are aids and examples contributing to the intended use of the index. Author

N74-20843*# TRW Systems, Redondo Beach, Calif.
CONIC PROGRAM USER'S MANUAL
Oct. 1973 48 p
(Contract NAS9-12330)
(NASA-CR-134238; TRW-20029-H221-R0-00; TRW-Note-73-FMT-927) Avail: NTIS HC $5.50 CSCL 09B

A user's manual for the current CONIC computer program is presented. The program was written in FORTRAN for use on the TRW Time Share system. The CONIC program is used to calculate the relative motion of two bodies in any conic-section orbit (circular, elliptical, parabolic, or hyperbolic). This manual describes the basic equations used for trajectory propagation and defines the input and output parameters of the program. Sample runs with corresponding figures and a detailed flow chart of the program are included. Author

N74-20844# National Bureau of Standards, Washington, D.C. Systems and Software Div.
A GUIDE TO NETWORKING TERMINOLOGY
A. J. Neumann Mar. 1974 31 p refs
(Grant NSF AG-350)
(NBS-TN-803) Avail: SOD HC $0.80 as C13.46:803

A selected set of terms and definitions relating to computer networking is presented in a coherent manner. The glossary is arranged alphabetically and contains about 140 definitions and associated terms. The sources of many terms are cited and modifiers indicate the status of definitions. Author

N74-20845# Bureau of Mines, Denver, Colo. Mining Research Center.
A COMPUTER PROGRAM FOR CLUSTERING DATA POINTS ON A SPHERE
Robert J. Shanley and M. Ashraf Mahtab 1974 61 p refs
(BM-IC-8624) Avail: NTIS HC $6.25

The computer program, HYBMODE, was developed to meet the need for a fast and economical method for clustering data points on the sphere. The algorithm used in this development is an extension of D. Wishart's one-level mode analysis. The program can be used to cluster either vectorial or axial data. Author

N74-20846# Lockheed Missiles and Space Co., Palo Alto, Calif.
TWO-SIDED CODING DISC
A. I. Chebarev [1973] 2 p refs Transl. into ENGLISH from Izv. Vysshikh. Uchebn. Zavedenii, Priborostr. (Leningrad), no. 8, 1971 p 72-74
Avail: NTIS HC $4.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A description is given of a coding disk from which the information sampling is accomplished by a contactless method, based on the principle of stopping the generation of oscillations. In order to increase the resolution and accuracy of conversion, the metallized code field of the disk, executed from an insulator, is deposit shifted by one place on each side. Author

N74-20847# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
AN ELEMENTARY DERIVATION OF ROSENBROCK'S MINIMAL REALIZATION ALGORITHM
D. Q. Mayne May 1972 5 p refs
(Publ-72/38) Avail: NTIS HC $4.00

Most minimal realization procedures utilize the Hankel matrix, or properties of the controllability matrix. Recently a useful algorithm, to obtain minimal realizations, was developed by Rosenbrock, using the system theory developed by him. It is shown that the algorithm can be simply developed using the properties of similarity transformation and matrix reduction procedures. Author (ESRO)

N74-20848# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
FIRST ORDER STRONG VARIATION ALGORITHMS FOR OPTIMAL CONTROL
D. Q. Mayne and E. Polak (Calif. Univ., Berkeley) Dec. 1972 23 p refs Sponsored in part by Sci. Res. Council
(Publ-72/39) Avail: NTIS HC $4.25

Two demonstrably convergent, first order, differential dynamic programming algorithms for the solution of optimal control problems with constraints on the control, but without constraints on the trajectory or the terminal state are presented. The second of these two algorithms can be used on more difficult problems than the first one, but it is correspondingly more complex. Author (ESRO)

N74-20849# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
MAGNETIC TAPE CONVERSION PROGRAM (MTC)
K. C. Daly May 1973 11 p
(Publ-73/11) Avail: NTIS HC $4.00

A magnetic tape conversion program is described which performs conversions between 7-track BCD magnetic tapes and ASC11, DEC compatible tapes. Allowance is made for a wide range of secondary parameters and the command structure used.

gives the flexibility required for any desired data retrieval operation. ESRO

N74-20850# Freiburg Univ. (West Germany). Inst. fuer Physik.
MICROPROGRAMMED STANDARD FUNCTIONS FOR A BASIC COMPUTER [MIKROPROGRAMMIERTE STANDARDFUNKTIONEN FUER EINEN BASIC-RECHNER]
Binfried Wagner Sep. 1973 77 p refs In GERMAN
(Rept-C-22) Avail: NTIS HC $7.00

Algorithms for standard functions of the BASIC programming language, such as sine, cosine, tangent, exponential functions, logarithm, and square root, were derived. The realization of these functions for the BASIC computer being designed at the University of Freiburg, in micro command control mode, is discussed. The computational speed of this implementation is compared with the software implementation of other computers. ESRO

N74-20851# Royal Aircraft Establishment, Farnborough (England).
FLANG: A FLOWCHART LANGUAGE FOR PROSPERO OPERATIONS
P. G. Earwickrer Sep. 1973 25 p refs
(RAE-TR-73115; BR36977) Avail: NTIS HC $4.25

FLANG is a simple programming language in which the programs are flow charts. Programs written in FLANG have been successfully used to control the British satellite Prospero. An abstract description of FLANG is given which may be regarded as both an implementation specification and a programming manual. ESRO

N74-20852# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METHOD FOR REALIZING FUNCTIONS OF A PROGRAM-TIME DEVICE ON A HIGH-SPEED COMPUTER USED IN A SYSTEM FOR CONTROLLING THE EQUIPMENT ABOARD SPACECRAFT
I. V. Shamanov 8 Jan. 1974 21 p ref Transl. into ENGLISH from the publ. "Matematicheskie Metody Modelirovaniya v Kosmicheskikh Issledoveniyakh" USSR, 1971 p 22-33
(AD-773269; FTD-HT-23-313-74) Avail: NTIS CSCL 09/2

The function of the program time device (PVU) consists of producing a series of control instructions called elementary time programs. Instructions to the PVU input are given in sequence at the given time intervals. From the PVU the instructions are fed to the input of the device which executes logical operations and then on to the onboard equipment. The results of a study indicate that: (1) A method developed for simulating the functions of the program time device allows a program to be composed which realizes the functions of the PVU. (2) The program would afford the possibility of obtaining at the output, the values of the variables which are equivalent to the PVU instructions at every step of change in time t. (3) To realize the function of the PVU in the control system, it is necessary that the computer operate in accordance with a real time scale. (4) This can be accomplished by transmitting the simulation program from a simulating device to the computer at the time intervals which are equal to step Delta t. D.L.G.

N74-20853*# Hawaii Univ., Honolulu.
[RANDOM ACCESS RADIO COMMUNICATION AND MULTIPROCESSOR COMPUTING STRUCTURES OF ALOHA SYSTEM] Annual Technical Report, year ending 31 Dec. 1973
Franklin F. Kuo Jan. 1974 33 p refs
(Contract NAS2-6700; ARPA Order 1956)
(NASA-CR-137398; AD-773416; B74-1) Avail: NTIS HC $4.75 CSCL 09/2

Work in the ALOHA system is divided into two tasks: (1) To develop new methods and protocols for random access radio communications for computers; (2) To study systematic designs for multiprocessor computing structures through the developments of the BCC 500 system. Accomplishments for 1973 are discussed. GRA

N74-20854# Robot Research, Inc., San Diego, Calif.
SIMPLE ELECTROCHEMICAL CIRCUITS FOR LARGE SCALE REAL TIME INFORMATION PROCESSING Final Report
Joseph K. Hawkins Dec. 1973 117 p refs
(Contract F33615-70-C-1314; AF Proj. 7232)
(AD-773855; RR-7301; AMRL-TR-73-41) Avail: NTIS CSCL 09/2

Investigations of possible techniques for implementing large parallel arrays of image processing elements were performed. Electrochemical approaches were first investigated and based upon analysis of reports were found to be feasible for implementing functions involving signal (image) amplification. However, no reasonable approach to the problem of forming large numbers of complex interconnections was uncovered. Experimental and theoretical investigations of electron-optical implementations of parallel arrays were also performed. With this implementation, interconnections can be readily made and parallel or serial amplification performed. Laboratory experiments documenting problems with resolution, uniformity, defects, etc. were performed and the results are presented in this report. Author (GRA)

N74-20855# Stanford Research Inst., Menlo Park, Calif.
AN INTERACTIVE FACILITY FOR SCENE ANALYSIS RESEARCH Final Report
J. M. Tenenbaum, T. D. Garvey, S. Weyl, and H. C. Wolf Jan. 1974 49 p refs
(Contract N00014-71-C-0294; SRI Proj. 1187)
(AD-774711) Avail: NTIS CSCL 09/2

The report describes initial progress towards the development of a computer system that can be rapidly programmed to analyze any class of pictorial scenes. It has been awkward to develop scene analysis programs using conventional programming systems because of the difficulty of formalizing pictorial descriptions in symbolic terms. Picture processing techniques are inherently ad hoc and must be deduced empirically for each application. An interactive system specifically designed for expressing and experimenting with perceptual strategies is constructed. The system allows an experimenter to describe basic perceptual concepts to a computer in terms of pictorial examples. The examples are designed graphically by encircling areas of a displayed scene with a cursor. A concept is represented internally by values of primitive feature-extraction operators that distinguish it from examples of previously defined concepts. Concepts so defined constitute a common vocabulary, shared by man and machine, that can be used symbolically in describing objects and specifying scene analysis procedures. (Modified author abstract) GRA

N74-20856# Air Force Systems Command, Wright-Patterso AFB, Ohio. Foreign Technology Div.
SUPERCONDUCTING MEMORY DEVICES
I. D. Boimovich and R. A. Chentsov 15 Jan. 1974 16 p refs Transl. into ENGLISH from Upr. Sist. i Mashiny (USSR), no. 1, Sep./Oct. 1972 p 110-114
(AD-774397; FTD-HT-23-545-74) Avail: NTIS CSCL 09/2

The report discusses the advancement of superconducting computer storage; its simplicity, size, economy, and reliability. GRA

N74-20857# Naval Electronics Lab. Center, San Diego, Calif.
THREE-TO-ONE DATA COMPRESSION VIA WALSH TRANSFORM Research and Development Report, FY 1973 and FY 1974
D. C. McCall 10 Dec. 1973 35 p refs
(NELC Proj. Z257; NELC Proj. Z268)
(AD-774082; NELC-TR-1903) Avail: NTIS CSCL 09/2

Naval Electronics Laboratory Center (NELC) has emulated a Walsh transform source encoder. This data compression technique has given three-to-one compression while maintaining good image fidelity. A digital frame capture unit (DFCU) is used to digitize images into a format suitable for processing on a digital computer. The encoder is emulated with a digital computer program that processes the digitized images. These processed images can then be displayed on the TV monitor of the DFCU for evaluation. Greater compression is feasible. Author (GRA)

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N74-20858 Rensselaer Polytechnic Inst., Troy, N.Y.
ELECTRON CONDUCTION IN QUANTIZED SILICON INVERSION LAYERS WITH MANY OCCUPIED ELECTRIC SUBBANDS Ph.D. Thesis
Arthur Robert Nelson 1973 115 p
Avail: Univ. Microfilms Order No. 74-5149

The electron transport in an n-type silicon inversion layer of a MOS device has been examined theoretically. When a sufficiently large gate voltage is applied, quantum effects become apparent. The strong electric field perpendicular to the surface splits the conduction band into discrete electric subbands, thereby quantizing the motion normal to the surface. The electron mobility and magnetoconductance has been calculated for the situation when many electric subbands are occupied and interband scattering is included. Dissert. Abstr.

N74-20859* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RAPIDLY PULSED, HIGH INTENSITY, INCOHERENT LIGHT SOURCE Patent
John C. Evans, Jr. and Henry W. Brandhorst, Jr., inventors (to NASA) Issued 23 Apr. 1974 6 p Filed 13 Sep. 1972 Supersedes N72-32229 (10 - 23, p 3066) Continuation-in-part of US Patent Appl. SN-848403, filed 29 Jul. 1968, which is a division of abandoned US Patent Appl. SN-487929, filed 16 Aug. 1965
(NASA-Case-XLE-2529-3; US-Patent-3,806,835;
US-Patent-Appl-SN-288856; US-Patent-Class-332-7.51;
US-Patent-Class-331-94.5D; US-Patent-Class-315-211;
US-Patent-Class-315-228; US-Patent-Appl-SN-848403;
US-Patent-Appl-SN-487929) Avail: US Patent Office CSCL 09E

A rapid pulsing, high intensity, incoherent light is produced by selectively energizing a plurality of discharge lamps with a triggering circuit. Each lamp is connected to a capacitor, and a power supply is electrically connected to all but one of the capacitors. This last named capacitor is electrically connected to a discharge lamp which is connected to the triggering circuit.
Official Gazette of the U.S. Patent Office

N74-20860* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AMPLITUDE STEERED ARRAY Patent
Fred J. Dietrich (Philco-Ford Corp., Palo Alto, Calif.), George J. Koloboff (Philco-Ford Corp., Palo Alto, Calif.), Robert J. Martel (Westinghouse Elec. Corp., Pittsburgh), and Chester C. Johnson, inventors (to NASA) Issued 23 Apr. 1974 8 p Filed 15 Jun. 1972 Supersedes N73-32117 (11 - 23, p 2764) Sponsored by NASA
(NASA-Case-GSC-14446-1; US-Patent-3,806,932;
US-Patent-Appl-SN-263230; US-Patent-Class-343-100SA;
US-Patent-Class-343-100ST; US-Patent-Class-343-854;
US-Patent-Class-343-DIG.2) Avail: US Patent Office CSCL 09A

A spin stabilized satellite has an electronically despun antenna array comprising a multiplicity of peripheral antenna elements. A high gain energy beam is established by connecting a suitable fraction or array of the elements in phase. The beam is steered or caused to scan by switching elements in sequence into one end of the array as elements at the other end of the array are switched out. The switching transients normally associated with such steering are avoided by an amplitude control system. Instead of abruptly switching from one element to the next, a fixed value of power is gradually transferred from the element at the trailing edge of the array to the element next to the leading edge. Official Gazette of the U.S. Patent Office

N74-20861* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ROTARY SOLENOID SHUTTER DRIVE ASSEMBLY AND ROTARY INERTIA DAMPER AND STOP PLATE ASSEMBLY Patent
Walter L. Cable (RCA, Princeton, N. J.) and Harold B. Dougherty, inventors (to NASA) (RCA, Princeton, N. J.) Issued 16 Apr. 1974 8 p Filed 21 May 1973 Supersedes N73-26198 (11 - 17, p 2003) Sponsored by NASA
(NASA-Case-GSC-11560-1; US-Patent-3,804,506;
US-Patent-Appl-SN-361906; US-Patent-Class-354-234;
US-Patent-Class-95-53EA; US-Patent-Class-350-269) Avail: US Patent Office CSCL 09E

A camera shutter assembly composed of a pair of superposed opaque planar shutter blades, each having an aperture and being arranged for reciprocal linear movement is disclosed. A pair of rotary solenoids, each connected to one of the blades by a linkage and arranged to be actuated separately at a predetermined interval is provided. An inertia damper and stop plate is built into each solenoid to prevent rebound.
Official Gazette of the U.S. Patent Office

N74-20862* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ULTRA-STABLE OSCILLATOR WITH COMPLEMENTARY TRANSISTORS Patent
Leonard L. Kleinberg, inventor (to NASA) Issued 23 Apr. 1974 6 p Filed 14 Dec. 1972 Supersedes N73-16185 (11 - 07, p 0761)
(NASA-Case-GSC-11513-1; US-Patent-3,806,831;
US-Patent-Appl-SN-315069; US-Patent-Class-331-116R;
US-Patent-Class-331-108A; US-Patent-Class-331-115;
US-Patent-Class-331-159) Avail: US Patent Office CSCL 09E

A high frequency oscillator, having both good short and long term stability, is formed by including a piezoelectric crystal in the base circuit of a first bi-polar transistor circuit, the bi-polar transistor itself operated below its transitional frequency and having its emitter load chosen so that the input impedance, looking into the base thereof, exhibits a negative resistance in parallel with a capacitive reactance. Combined with this basic circuit is an auxiliary, complementary, second bi-polar transistor circuit of the same form with the piezoelectric crystal being common to both circuits. By this configuration small changes in quiescent current are substantially cancelled by opposite variations in the second bi-polar transistor circuit, thereby achieving from the oscillator a signal having its frequency of oscillation stable over long time periods as well as short time periods.
Official Gazette of the U.S. Patent Office

N74-20863* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HIGH EFFICIENCY MULTIFREQUENCY FEED Patent
James S. Ajioka (Hughes Aircraft Corp., Los Angeles), George I. Tsuda (Hughes Aircraft Corp., Los Angeles), and William A. Leeper, inventors (to NASA) (Hughes Aircraft Corp., Los Angeles) Issued 9 Apr. 1974 11 p Filed 14 Apr. 1972 Sponsored by NASA
(NASA-Case-GSC-113173; US-Patent-3,803,617;
US-Patent-Appl-SN-244158; US-Patent-Class-343-730;
US-Patent-Class-343-786; US-Patent-Class-343-797;
US-Patent-Class-343-853) Avail: US Patent Office CSCL 09A

Antenna systems and particularly compact and simple antenna feeds which can transmit and receive simultaneously in at least three frequency bands, each with high efficiency and polarization diversity are described. The feed system is applicable for frequency bands having nominal frequency bands with the ratio 1:4:6. By way of example, satellite communications telemetry bands operate in frequency bands 0.8 - 1.0 GHz, 3.7 - 4.2 GHz and 5.9 - 6.4 GHz. In addition, the antenna system of the invention has monopulse capability for reception with circular or diverse polarization at frequency band 1.
Official Gazette of the U.S. Patent Office

N74-20864* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TURNSTILE SLOT ANTENNA Patent
Robert E. Munson, inventor (to NASA) (Ball Brothers Res. Corp., Boulder, Colo.) Issued 16 Apr. 1974 5 p Filed 27 Sep. 1972 Supersedes N73-11206 (11 - 02, p 0149) Sponsored

by NASA
(NASA-Case-GSC-11428-1; US-Patent-3,805,266; US-Patent-Appl-SN-292685; US-Patent-Class-343-708; US-Patent-Class-343-769; US-Patent-Class-343-853) Avail: US Patent Office CSCL 17B

A turnstile slot antenna is disclosed, the antenna being for and integral with a spacecraft having a substantially cylindrical body portion. The antenna comprises a circumferential slot about the periphery of the spacecraft body portion with an annular wave guide cavity defining a radial transmission line disposed within the spacecraft body portion behind and in communication with the circumferential slot. Feed stubs and associated transmission apparatus are provided to excite the annular cavity in quadrature phase such that an omnidirectional, circularly polarized, rotating radiation pattern is generated. The antenna of the instant invention has utility both as a transmitting and receiving device, and ensures continuous telemetry and command coverage with the spacecraft.
Official Gazette of the U.S. Patent Office

N74-20865*# Linguistic Systems, Inc., Cambridge, Mass.
ELECTRICAL CONDUCTIVITY OF ION EXCHANGE MEMBRANES AND THE INHOMOGENEITY OF THEIR STRUCTURE
V. K. Varentsov and M. V. Pevnitskaya Washington NASA Mar. 1974 12 p refs Transl. into ENGLISH from Izv. Sib. Otd. Akad. Nauk SSSR, Ser. Khim. Nauk (USSR), v. 2, no. 4, 1973 p 3-8
(Contract NASw-2482)
(NASA-TT-F-15339) Avail: NTIS HC $4.00 CSCL 09A

The electrical conductivity of a number of ion exchange membranes is studied. Topics discussed include iogenic groups, production technology, total exchange capacity, the nature of the concentration, and the temperature of the solution. It is shown that the spatial distribution of ionogenic groups has a critical influence on the value of the electrical conductivity but not on their total number. Author

N74-20866# Centre National de la Recherche Scientifique, Toulouse (France). Lab. d'Automatique et d'Analyse des Systemes.
CHARACTERIZATION OF PN JUNCTIONS USING CAPACITANCE MEASUREMENTS [CARACTERISATION DES JONCTIONS PN A PARTIRDE MESURES DE CAPACITE]
A. MunozYague Nov. 1973 23 p refs In FRENCH
(LAAS-CEP-73-I-34; CEP-LAAS-73-I-34) Avail: NTIS HC $4.25

General theoretical formulae corresponding to common use p-n junctions for the transition zone capacitance are reviewed with regard to ideal functions, linearly varying impurity concentration junctions, and exponential profile junctions. Graphical methods of characterization are discussed. A numerical analysis is presented detailing the determination of the parameters under the various cases mentioned above and the approximation of the impurities profile. The technique of utilization of the computer program is dealt with. ESRO

N74-20867# Heimann G.m.b.H., Wiesbaden (West Germany).
APPLICATION OF FERROELECTRIC CRYSTALS WITH LARGE PYROELECTRIC EFFECT IN ELECTRON BEAM SCANNING CAMERA TUBES (THERMAL CAMERA TUBE) [UNTERSUCHUNGEN UEBER DIE MOEGLICHKEIT, FERROELEKTRISCHE KRISTALLE MIT GROSSEM PYROELEKTRISCHEN EFFEKT IN BILDAUFNAHMEROEHREN MIT ELEKTRONENSTRAHLABTASTUNG ZU VERWENDEN (WAERMEBILDAUFNAHMEROEHRE)]
P. W. Steinhage Bonn Bundeswehramt 1973 64 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(BMVg-FBWT-73-37) Avail: NTIS HC $6.25; Bundeswehramt 30 DM

The specific differences of a thermal image tube with pyroelectric target were compared with conventional thermographic systems. The physical principles are outlined and the image forming mechanism, as well as the optimal scanning conditions, are described. Such optimization necessitates the adaption of the number of lines and the frame rate to the electrical and thermal properties of the target. In order to image stationary temperature distributions the incident radiation must be chopped. Scanning and chopping are to be synchronized. The requirements for the properties of the basic material and production procedures for TGS single crystals and thin slices are furnished. Experimental results pertaining to the suitability of various pyroelectrics were compared. TGS was found to be the best suited material due to pyroelectric figure of merit and low volume specific heat. Theoretical assumptions about the physical processes in the tube were experimentally verified. Author (ESRO)

N74-20868# Admiralty Surface Weapons Establishment, Portsmouth (England).
THE APPLICATION OF A WAVEGUIDE FEED TO A SHORT BACKFIRE ANTENNA
A. C. Large Apr. 1973 14 p refs
(TR-73-16; BR36661) Avail: NTIS HC $4.00

Application of a waveguide feed to the short backfire type of antenna produces a simple, compact antenna design suitable for use with high microwave powers. The antenna can replace waveguide feed horns and polyrods that have similar radiation properties but considerably greater physical length. Waveguide feeds with both rectangular and circular cross sections were tested on an experimental antenna at superhigh frequencies.
Author (ESRO)

N74-20869# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
CAD. OF MASKS AND WIRING
M. C. VanLier and R. H. J. M. Otten Feb. 1974 110 p refs
(TH-74-E-44) Avail: NTIS HC $8.50

Algorithms are discussed for application in computerized design of monolithic integrated circuit masks and wiring. A simple minimum-distance model is generalized so that the outcome is an abstract model. A short introduction to notions in graph theory is presented. Four planarity tests are reviewed: CEL-algorithm, pseudo-Hamiltonian method, methods using matrices, and whirl method. The planarization of nonplanar networks is considered.
ESRO

N74-20870# European Space Research Organization, Paris (France).
PERFORMANCE AND APPLICATIONS OF SEMICONDUCTOR OUTPUT STAGES IN THE FREQUENCY RANGE FROM THE L-BAND TO THE Ku-BAND
Bodo Schmidt Jan. 1974 33 p refs Transl. into ENGLISH of Leistungsfaehigkeit und Einsatzmoeglichkeiten von Halbleiterendstufen vom L-band bis zum Ku-Band, DLR-MITT-73-06, DFVLR, 1973
(ESRO-TT-11; DLR-MITT-73-06) Avail: NTIS HC $4.75; Original report in GERMAN: DFVLR, Porz, West Ger. 11,50 DM

A state of the art survey in semiconductor techniques for microwave generation and amplification in the 1-15 GHz frequency range is presented. Semiconductor components and techniques are being developed with the object of opening up new frequency ranges in order to meet the increasing communications requirements. Apart from the use of transistors and varactors for the lower GHz ranges, advances in Gunn and Impatt diode development suggest that these will be perfectly suitable for a number of applications in the X and Ku bands. Author (ESRO)

N74-20871# Lincoln Lab., Mass. Inst. of Tech., Lexington.
REVIEW OF HIGH-RELIABILITY PROCUREMENT PRACTICES IN THE SEMICONDUCTOR INDUSTRY
Alan G. Stanley 11 Jan. 1974 36 p refs
(Contract F19628-73-C-0002)
(AD-773833; TN-1974-2; ESD-TR-74-11) Avail: NTIS CSCL 09/1

High-reliability procurement practices in the semiconductor industry have been reviewed in the light of Lincoln Laboratory experience over the past two years. The merits and drawbacks of different types of product assurance methods and specification systems are described. A different kind of procurement method is proposed, in which devices are obtained from the vendors in wafer form on the basis of stringent wafer acceptance tests and subsequently processed on a controlled line under strict quality control conditions including in-process quality control tests, positive lot control and exhaustive screens. Author (GRA)

N74-20872# Polhemus Navigation Sciences, Inc., Burlington, Vt.
AN ELECTROMAGNETIC POSITION SENSOR Final Report, 2 Oct. 1972 - 31 May 1973
Aurale R. DeRuyck and Jack Kuipers 30 Nov. 1973 97 p refs
(Contract F33615-73-C-1027)
(AD-774587; AFAL-TR-73-281) Avail: NTIS CSCL 09/3

One of many Air Force concepts requires that the physical alignment of separate system parts be aligned to each other so that the system will operate correctly. This method of alignment is termed transfer of alignment. This report deals with transfer of alignment by the use of radiated magnetic waves. This report details the design and laboratory testing of the Space Synchro (SPASYN) which is a five-degree-of-freedom transducing technique used to detect the orientation of one body with respect to another in measurements of pitch, roll and yaw angular displacements. The system consists of a Radiator, Sensor, Radiator Excitation Unit (REU), and System Control and Display Unit (SCDU). GRA

N74-20873# Westinghouse Research Labs., Pittsburgh, Pa.
MICROWAVE FIELD EFFECT TRANSISTOR DEVELOPMENT Final Report, 18 Jun. 1972 - 31 May 1973
Michael C. Driver, Martin J. Geisler, Donovan L. Barrett, and He. B. Kim Nov. 1973 71 p refs
(Contract F30602-72-C-0831)
(AD-774462; RADC-TR-73-350) Avail: NTIS CSCL 09/1

The report describes the development of a gallium arsenide Schottky barrier gate field effect transistor to deliver power at microwave frequencies. The program achieved 1.2 watts of saturated power at 3.0 GHz with six small (500 micrometers wide) devices wired in parallel on a single chip carrier. The small signal gain of individual devices at this frequency was as high as 10 db with cut off frequencies of 10 GHz. A 5 db gain at 3 GHz with 800 milliwatts of output power was achieved with 6 devices in parallel. Measurements were made of intermodulation products showing -23 db third order IMP at small signal levels which is a typical result for devices that have not been optimized for low harmonic distortion. A mercury probe was developed for the rapid evaluation of epitaxial material for FET fabrication. (Modified author abstract) GRA

N74-20874# Braddock, Dunn and McDonald, Inc., Albuquerque, N.Mex.
HERTZIAN GENERATOR DEVELOPMENT Final Report
S. D. Houston and David Bailey Dec. 1973 75 p refs
(Contract F30602-72-C-0388; AF Proj. 5573)
(AD-774567; BDM/A-90; RADC-TR-73-325) Avail: NTIS CSCL 09/5

The report summarizes the results of a one-year theoretical and experimental study of the frozen wave Hertzian concept for electromagnetic wave generation. The bulk of the effort was devoted to the switch problem, in particular, switch synchronization. Several configurations are evaluated and the design of a 200 MHz generator is treated in some detail. Limitations on frequency, efficiency, power, etc., are discussed in terms of available switch technology, materials, etc. Author (GRA)

N74-20875# Hebrew Univ., Jerusalem (Israel). Racah Inst. of Physics.
INVESTIGATION OF RADIATION EFFECTS ON QUARTZ CRYSTALS AND OSCILLATORS Final Scientific Report
A. Halperin, J. Levinson, A. A. Braner, D. Zloto, and J. Nahir Jul. 1973 33 p refs
(Grant AF-AFOSR-2366-72; AF Proj. 5611)
(AD-774633; AFCRL-TR-73-0592) Avail: NTIS CSCL 09/1

Effects of electrical sweeping and of 5-MeV electron irradiation on quartz resonators are described. The infrared absorption bands in the 3 micrometer range were examined, and the temperature dependence of a few lines in crystals that contained Li+, Na+ or H+ was found to give activation energies of about 0.1 eV. The currents during electrolytic diffusion at 500C was found to be almost independent on the thickness of the sample down to thicknesses of 0.05 mm. In a prolonged diffusion experiment in which K+ ions were introduced into a quartz crystal, the resonator ceased oscillating, presumably because of an uneven distribution of the K+ ions in the crystal. The effects of electron-irradiation on the Q-values and frequencies of quartz resonators were examined in various experiments, both during and after the termination of the irradiation. Preirradiation of a resonator was found to improve its behavior on further irradiations. Author (GRA)

N74-20876# Michigan Univ., Ann Arbor. Electron Physics Lab.
MICROWAVE SOLID-STATE DEVICE AND CIRCUIT STUDIES Quarterly Progress Report, 1 Mar. - 1 Jun. 1973
G. I. Haddad Nov. 1973 120 p refs
(Contract F30602-71-C-0099; AF Proj. 5573)
(AD-774456; RADC-TR-73-351; QPR-11) Avail: NTIS CSCL 09/1

This is the eleventh quarterly progress report on subject contract whose objectives are to investigate theoretically and experimentally new solid-state phenomena and techniques having application to microwave generation, amplification, and control. Current tasks under this program are: Modulation properties of Gunn-Effect Devices; properties of IMPATT Diodes; High-efficiency Avalanche Diodes; properties of TRAPATT Diodes; Field-effect Transistors; Solid-state Device Fabrication. Author (GRA)

N74-20877# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
EVALUATION OF DIFFERENTIAL AMPLIFIER, MICROCOM CORPORATION MODEL MA-20.09 Final Report
Sidney Scheindlinger 12 Dec. 1973 8 p
(AD-774107; NADC-73238-30) Avail: NTIS CSCL 09/5

Laboratory tests were conducted on two light-weight (0.17 ounce) differential amplifiers for use with low-level strain gages. Over the temperature range of -60F to +250F and an elapsed time of 46 days, the combined effects of zero shift and gain variation introduce errors less than plus or minus 3% of full scale. These amplifiers are considered satisfactory for the intended application. (Modified author abstract) GRA

N74-20878# North Hills Associates, Glen Cove, N.Y.
RESEARCH PROGRAM ON MULTIDIMENSIONAL MATRIX ADDRESSING TECHNIQUES Final Report, 1 Aug. 1972 - 30 Sep. 1973
Sol Sherr, Al Loshin, and Arnold Spitalny 28 Dec. 1973 222 p refs
(Contract N00014-73-C-0152; NR Proj. 215-210)
(AD-774143) Avail: NTIS CSCL 09/5

A research program is reported in which multidimensional addressing techniques are investigated, theoretically and empirically. Techniques included are electrical, optical and gas discharge. In addition several models are described using liquid crystals as the display media and a combination of electrical and optical addressing in single and multi-layer assemblies. (Modified author abstract) GRA

N74-20879# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
RADIO FREQUENCY RF POWER LIMITATIONS FOR OCTAVE BANDWIDTH TRAVELING WAVE TUBES
Walter Friz Nov. 1973 94 p refs
(AF Proj. 6098)
(AD-774591; AFAL-TR-73-283) Avail: NTIS CSCL 09/1

An analysis is given pointing out the physical limitations for the output Radiofrequency (RF) power of octave bandwidth helix TWT's with solid electron beams. An absolute upper output limit is reached with the frequency independent upper RF power limit approximately equal to 2.5 KW at the long wave length end of the microwave spectrum. (Modified author abstract) GRA

N74-20880# Systems Research Labs., Inc., Dayton, Ohio.
THE DEVELOPMENT AND EVALUATION OF AN OPTIMIZED VIDEO OUTPUT FROM A WIDE ANGLE OPTICAL PROBE Final Report, Feb. 1972 - Mar. 1973
Joe A. Mays and Kenneth M. Irish Dec. 1973 146 p refs
(Contract F33615-72-C-1270; AF Proj. 6114)
(AD-774577; AFHRL-TR-73-22) Avail: NTIS CSCL 05/9

The report describes a two-phase program to develop an optimized video output from a wide angle optical probe.

Phase 1 of the program presents data resulting from radiometric and photometric studies of model paints, textures and illumination sources; performance data resulting from tests conducted on the wide angle optical probe; and a preliminary system design. Phase 2 of the program dealt with system development and evaluation. The report describes the detailed design of the high resolution 2-inch vidicon camera, including particular emphasis on the wideband video preamplifier and video processing electronics. The evaluation phase of the program includes data concerning the performance of the television system, and the performance of the integrated system including the optical probe, magnifying image intensifier and ultra high resolution 2-inch vidicon camera. The conclusion reached by examination of the resultant data supports the belief that a truly optimized video output from a wide angle optical probe has been achieved.
Author (GRA)

N74-20881# Harvard Univ., Cambridge, Mass. Gordon McKay Lab.
A MATHEMATICAL MODEL FOR THE IMPEDANCE OF CAVITY-BACKED SLOT ANTENNAS
Stuart A. Long Oct. 1973 50 p refs
(Contract F19628-74-C-0060; AF Proj. 5635)
(AD-774466; AFCRL-TR-73-0695; SR-1) Avail: NTIS CSCL 09/5

A mathematical model is derived which relates the impedance of a cavity-backed slot antenna to that of an identical slot which is free to radiate on both sides of a large ground plane. The model, which uses empirical constants from a previous experimental investigation, provides a continuously variable function for the impedance of the cavity-backed slot. This function is then compared with the previously found experimental values and approximate solution using variational techniques. Author (GRA)

N74-20882# Braddock, Dunn and McDonald, Inc., Vienna, Va.
PICOSECOND PULSE REFLECTOR ANTENNA INVESTIGATION Final Technical Report, 17 Mar. 1972 - 17 Jan. 1973
Vasco C. Martins, Joseph L. VanMeter, Joseph M. Proud (IKOR, Inc.), and Derek J. Fitzgerald (IKOR, Inc.) Jul. 1973 328 p refs
(Contract F30602-72-C-0276; AF Proj. 4506)
(AD-774132; BDM/W-TR-73-143; RADC-TR-73-215) Avail: NTIS CSCL 09/5

Research was performed in a combined theoretical and experimental effort to investigate the performance of a number of classes of reflector-feed antenna systems to picosecond duration video-like signals. The overall objective was to develop and employ time domain concepts and measurement techniques to establish design guidelines and procedures which will enable selection and design of high performance short pulse antenna feed and reflector configurations. Theoretical analyses were devoted to developments of reflector-feed transfer functions and performance criteria such as efficiency, gain, fidelity feed pattern, polarization, and aperture for the monopole, bicone, TEM Horn and bow tie feed types. Experimental efforts were keyed to the theoretical program and to investigate the conclusions reached from that study. (Modified author abstract) GRA

N74-20883# Northrop Corp., Hawthorne, Calif.
EBS DIODE ARRAYS Final Report
K. K. Schuegraf Jan. 1974 50 p refs
(Contract DAAB07-73-C-0086; DA Proj. 1S6-62705-A-440)
(AD-774285; NRTC-73-45R) Avail: NTIS CSCL 09/1

The objective of this study was to determine methods of fabricating an array of fifth silicon diodes for application in an electron beam semiconductor (EBS) device. Lateral dimensions of the diode array specified in the procurement specification were necessary requirements. The diode arrays were processed with poly silicon and aluminum as well as phosphorous glass passivating layers. An evaluation of the stability of the diode reverse characteristics under electron bombardment was made. Measurements of electron gain and pulse response were performed. Several 50 element diode arrays were fabricated, tested and evaluated. Recommendations for making electrical connections to the diode arrays were made. (Modified author abstract) GRA

N74-20884# General Electric Co., Schenectady, N.Y.
DESIGN, FABRICATION, AND EVALUATION OF AN ELECTRON BEAM ADDRESSABLE HIGH INFORMATION DENSITY MEMORY TUBE Quarterly Progress Report, 1 May - 31 Jul. 1973
Dec. 1973 28 p
(Contract DAAB07-72-C-0098; DA Proj. 1H6-31024-D-252)
(AD-773625; SRD-73-115; ECOM-0098-6; QPR-6) Avail: NTIS CSCL 09/2

Tests were made on a memory tube (BEAMOS Tube No. 5) containing tantalum anode apertures. Read-write tests were conducted for recording rates as high as 10 megabits per second. Preliminary testing of BEAMOS Tube No. 7 indicates a capability of 5.6 micrometer bit spacing at the 10 M bit record-read rate. Components and an improved memory tube were ordered and the tube redesign was completed. (Modified author abstract) GRA

N74-20885# Army Electronics Command, Fort Monmouth, N.J.
A FREQUENCY DIVIDER USING A CHARGE-COUPLED DEVICE
R. Bharat Dec. 1973 15 p refs
(DA Proj. 1S7-62705-A-440)
(AD-774253; ECOM-4179) Avail: NTIS CSCL 09/5

A scheme for using a charge-coupled device(CCD) as a divided-by-n counter is proposed, and a possible method of implementing it in an integrated version described. The proposed counter is non-binary and usable for arbitrary n. The relative merits and limitations of the integrated CCD frequency divider are discussed. Author (GRA)

N74-20886# Hughes Research Labs., Malibu, Calif.
MICROWAVE ACOUSTIC SURFACE WAVE DELAY LINES Final Report, 1 Feb. 1972 - 30 Apr. 1973
Edward D. Wolf and Rolf D. Weglein Aug. 1973 85 p refs
(Contract F19628-72-C-0127; AF Proj. 5635)
(AD-774016; AFCRL-TR-73-0570) Avail: NTIS CSCL 09/1

The final report contains a description of the electron beam microfabrication, transducer and matching circuit design, and packaging and testing (in certain cases) of 24 acoustic surface wave devices, including delay lines, filters and test structures. Electrode widths were varied from 0.45 to 3.0 micrometers; electrodes per transducer ranged from 7 to 274; transducers per crystal went as high as 6; and the substrates included lithium niobate, lithium tantalate, bismuth germanium oxide and quartz. A major portion of this program was the design, fabrication and evaluation of a particular bandpass filter. A set of conclusions are presented with general applicability. Author (GRA)

N74-20887# Hughes Aircraft Co., Fullerton, Calif.
ACOUSTIC SIGNAL PROCESSING DEVICES Semiannual Report, 1 May - 31 Oct. 1973
W. Richard Smith Feb. 1974 50 p refs
(Contract DAAB07-73-C-0175; DA Proj. 1S7-62705-A-057)
(AD-774283; FR-74-14-77; ECOM-0175-1) Avail: NTIS CSCL 09/1

The overall objective of this program is to expand the analysis and design of interdigital surface wave transducers. One specific goal is to better define and expand the transducer bandwidth capabilities, contrasting the cases of periodic and nonperiodic transducers and establishing which is preferable for a given application. A second objective is to combine the desirable features of circuit model analysis and weak coupling analyses so as to accurately describe the performance of both single and double electrodes up to at least the third harmonic, including an improved description of the effects of the electric load. This report describes our accomplishments through October 1973, which include development of broadband, nonperiodic transducer designs and an evaluation of the crossed-field and in-line circuit models for predicting effects of the electric load. Author (GRA)

N74-20888# Stanford Univ., Calif. Microwave Lab.
SURFACE WAVE PARAMETRIC PROCESSORS AND LONG DELAY LINES Semiannual Report, 1 Apr. - 30 Sep. 1973
H. J. Shaw Dec. 1973 86 p refs
(Contract DAAB07-73-C-0134)
(ECOM-0134-S; AD-774282; ML-2253) Avail: NTIS CSCL

09/1

The purpose of this research is to study means for the broadbanding of delay lines of long time delay, to form systems having time-bandwidth products exceeding 10,000, using passive, unguided propagation. The report presents experimental results on a delay line having 1/2 millisecond delay and 5 MHz bandwidth. This is a helical SAW delay line on a Bi12GeO20 wrap-around crystal plate, operating at 50 MHz, which proves that practical two-port delay lines operating in the millisecond range are within the current technology. An analysis has been made of the problem of broadbanding the transducers for long delay lines of this kind, which involve different considerations than for standard short delay lines. A loss balancing criterion is developed, and computer results are presented which show the general design parameters for delay lines having time delays extending to one millisecond together with bandwidth extending to 60 MHz, using graded interdigital transducer arrays. (Modified author abstract) GRA

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

N74-20889# Advisory Group for Aerospace Research and Development, Paris (France).

STANDARDIZATION OF THE PRINCIPAL ELECTROMAGNETIC SYMBOLS

P. Halley (Centre Natl. d'Etudes des Telecomun., Issy-les-Moulineaux) Feb. 1974 30 p in ENGLISH and FRENCH Revised

(AGARD-R-576-Rev-1) Avail: NTIS HC $4.50

Standard notations, symbols, and units used to express dimensionless values or numbers which pertain to electromagnetism are listed. E.H.W.

N74-20890# National Bureau of Standards, Washington, D.C. Electronic Technology Div.

SEMICONDUCTOR MEASUREMENT TECHNOLOGY: ARPA/NBS WORKSHOP. 1: MEASUREMENT PROBLEMS IN INTEGRATED CIRCUIT PROCESSING AND ASSEMBLY

Harry A. Schafft Feb. 1974 25 p Conf. held at Palo Alto, Calif., 7 Sep. 1973

(ARPA Order 2397)

(NBS-SP-400-3; LC-74-6000001) Avail: SOD HC $0.60 as C13.10:400-3

The dual purpose of the workshop was (1) to announce and describe the new effort, Advancement of Reliability, Processing, and Automation for Integrated Circuits with the National Bureau of Standards, (2) to obtain additional input on critical measurement problems in integrated circuit processing and assembly to assist in planning future work in the effort. The measurement problems in silicon, oxides, photolithography, and assembly and the problems in information dissemination that were identified by the participants are summarized. Included as appendices are summaries of two talks: one which described the results of earlier direct contacts with a cross section of industrial representatives on major measurement problems in integrated circuit processing and assembly and the other which described the initial plans for work in the effort. Author

N74-20891# Loughborough Univ. of Technology (England). Dept. of Mathematics.

ON THE STABILITY OF INTERCONNECTED SYSTEMS

P. A. Cook Nov. 1973 17 p refs Sponsored by Sci. Res. Council

(MATHS-Res-31) Avail: NTIS HC $4.00

A condition for input/output L(p)- stability, in terms of the L(p)- gains of the subsystems and their interconnections, was derived. For the case of L(2)-stability, it was compared with other criteria for asymptotic stability, obtained by Liapunov techniques. Author (ESRO)

N74-20892# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.

LINEAR SYSTEM SIMULATION (STEP) REFERENCE MANUAL

S. C. Chuang Jul. 1973 5 p ref

(Publ-73/19) Avail: NTIS HC $4.00

A computer program called STEP, written for simulating the step response of a linear constant continuous time system given in the transfer function form is described. It can be used for simulating both the open- and closed-loop response. A Pade approximation was used to reduce time delays to rational transfer function form. Application of the program was also considered. ESRO

N74-20893# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.

AN APPROXIMATE BAYESIAN ONE-STEP-AHEAD REGULATOR

G. C. Goodwin and R. L. Payne Aug. 1973 7 p refs

(Publ-73/27) Avail: NTIS HC $4.00

The design of an approximate Bayesian one-step-head regulator, based on first and second moments of the probability distribution of the system parameters is described. This approach is contrasted with the usual approach of using only the first moments in the standard minimum variance controller. When the output of the system is linear in the parameters, the second moment Bayesian control law has superior expected one step ahead performance. The Bayesian control law is easily implemented in the form of a finite dimensional feedback control law. Author (ESRO)

N74-20894# British Steel Corp., Sheffield (England). Information Services.

PRINTED CIRCUIT MANUFACTURE Open Report

L. C. F. Robinson Oct. 1973 6 p

(PB-225657/6GA; SM/TN/B/1585) Avail: NTIS HC $3.00 CSCL 09A

Printed circuits are used extensively by the Process Physics Section in the development of instrumentation. Their usefulness lies in the fact that they are relatively easy to make, highly reliable and sturdy. The manual explains the method currently used to manufacture printed circuits in the Process Physics Section. GRA

N74-20895# Battelle Memorial Inst., Columbus, Ohio.

FAULT ISOLATION VIA STATE VARIABLE ANALYSIS

Narindra N. Puri (Rutgers Univ.) and Harry A. Wheeler Jan. 1974 27 p refs

(Contract DAHC04-72-A-0001)

(AD-773817; ECOM-4186) Avail: NTIS CSCL 09/5

The report covers an algorithm for the parameter identification of a circuit from its frequency response. Author (GRA)

N74-20896# Maryland Univ., College Park.

FUNCTIONAL NETWORK THEORY AND MICROSYSTEMS Interim Scientific Report, 1972 - 1973

Robert W. Newcomb 19 Nov. 1973 6 p refs

(Grant AF-AFOSR-1910-70; AF Proj. 9749)

(AD-773347; AFOSR-74-0017TR) Avail: NTIS CSCL 09/5

The report is a brief summary of research accomplishments by the author and his coworkers on functional network theory and related microsystems. It identifies several topics, including operator theory, multivariable network theory, arithmetic coding for the construction of fault tolerant computers, hearing improvement electronic circuitry, cascade minimal gyrator synthesis and time variable transfer scattering matrix synthesis methods, in which significant results were obtained. It provides a listing of publications which contain the detailed technical findings. Author (GRA)

N74-20897# Lincoln Lab., Mass. Inst. of Tech., Lexington.

ADVANCED ELECTRONIC TECHNOLOGY Quarterly Technical Summary Report, 1 Aug. - 31 Oct. 1973

Melvin A. Herlin and Alan L. McWhorter 15 Nov. 1973 21 p refs

(Contract F19628-73-C-0002; AF Proj. 649L)

(AD-774451; ESD-TR-73-262) Avail: NTIS CSCL 09/5

The Quarterly Technical Summary covers the period 1 August through 31 October 1973. It consolidates the reports of Division

2 (Data Systems) and Division 8 (Solid State) on the Advanced Electronic Technology Program. Author (GRA)

N74-20898# Signatron, Inc., Lexington, Mass.
ELECTRONIC DEVICE MODELING Interim Technical Report, 13 Feb. - 13 May 1973
L. Ehrman Dec. 1973 59 p refs
(Contract F30602-73-C-0193)
(AD-774551; RADC-TR-73-362; ITR-1) Avail: NTIS CSCL 09/1

A review of basic background material for the Electronic Device Modeling effort is presented in this first quarterly technical report. The essentials of charge-control bipolar transistor models and their extension to the Gummell and Poon model are included together with initial comments upon their application to nonlinear transfer function determination. Basic properties of JFET and MOSFET theoretical models are also reviewed and the shortcomings, with respect to nonlinear models, are discussed briefly. Author (GRA)

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N74-20899*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TIME-DEPENDENT POLAR DISTRIBUTION OF OUTGASSING FROM A SPACECRAFT
John J. Scialdone Washington Apr. 1974 22 p refs
(NASA-TN-D-7597; G-7419) Avail: NTIS HC $3.00 CSCL 22A

A technique has been developed to obtain a characterization of the self-generated environment of a spacecraft and its variation with time, angular position, and distance. The density, pressure, outgassing flux, total weight loss, and other important parameters were obtained from data provided by two mass measuring crystal microbalances, mounted back to back, at distance of 1 m from the spacecraft equivalent surface. A major outgassing source existed at an angular position of 300 deg to 340 deg, near the rocket motor, while the weakest source was at the antennas. The strongest source appeared to be caused by a material diffusion process which produced a directional density at 1 m distance of about 1.6 x 10 to the 11th power molecules/cu cm after 1 hr in vacuum and decayed to 1.6 x 10 to the 9th power molecules/cu cm after 200 hr. The total average outgassing flux at the same distance and during the same time span changed from 1.2 x 10 to the minus 7th power to 1.4 x to the minus 10th power g/sq cm/s. These values are three times as large at the spacecraft surface. Total weight loss was 537 g after 10 hr and about 833 g after 200 hr. Self-contamination of the spacecraft was equivalent to that in orbit at about 300-km altitude. Author

N74-20900*# PBR Electronics, Inc., Athens Ala.
PHOTOLYSIS OF SPACECRAFT CONTAMINANTS Final Report
Gary L. Workman 29 Mar. 1974 17 p refs
(Contract NAS8-29197)
(NASA-CR-129026) Avail: NTIS HC $4.00 CSCL 14B

A molecular beam facility, which was designed to measure photochemical cross-sections, has been constructed at the Athens College science facility. The integration of this vacuum system into an operational photochemical instrument was performed with signal processing consisting of both dc and ac techniques. Of the experiments performed to date on the vacuum ultraviolet photolysis of water vapor, it is apparent that a larger pumping capacity (preferably with differential pumping) is required to improve upon the background signal. Both phase-sensitive detection and ion-counting techniques are recommended for future studies. Author

N74-20901# Institut Franco-Allemand de Recherches, St. Louis (France).
PRODUCTION OF STRONG SHOCK WAVES BY MEANS OF A LIGHT GAS GUN. PART 2: DEVELOPMENT OF WAVE PROFILES AND EXPERIMENTAL RESULTS [PRODUCTION D'ONDES DE CHOC INTENSES AU MOYEN D'UN CANON A GAZ LEGER. 2EME PARTIE: EVOLUTION DE LEUR PROFIL. RESULTATS EXPERIMENTAUX]
G. Kronenberger, L. Bobin, and J. P. Hancy 29 Jan. 1973 54 p refs In FRENCH
(Contract DTEN-72.170)
(ISL-6/73) Avail: NTIS HC $5.75

The pressure tube of a light gas gun was used as a shock tube high pressure chamber to generate strong shock waves. The experimental design, including the shock wave generator and pressure sensors, is described as well as some modifications to improve its performance such as enlargement of the tube diameters (up to 30 mm to diminish the viscous effect and lengthening of the tube up to 6 m to increase the intensity of the first shock). After investigation of the influence of gas initial pressure, membrane blast pressure and membrane materials (steel, terphane) on the shock profiles, terphane membranes with air instead of hydrogen as propagator were selected. Shocks attaining 650 m bar with single shock front were obtained. ESRO

N74-20902# National Center of Tribology, Risley (England). European Space Tribology Lab.
[ACTIVITIES OF THE EUROPEAN SPACE TRIBOLOGY LABORATORY] Annual Report, Mar. - Dec. 1972
1973 19 p Sponsored by ESRO
(ESRO-ESTL-1; ESRO-CR(P)-357; AR-1) Avail: NTIS HC $4.00

The purpose, structure, and management of the European Space Tribology Laboratory are reviewed. The construction of the laboratory, plant, and equipment are described. The laboratory preparation for mechanism tests is described, and research and development is also discussed. ESRO

N74-20903# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Flugfunk und Mikrowellen.
THE ANTENNA TOWER TEST RANGE OF THE DFVLR AT OBERPFAFFENHOFEN [DIE TURMMESSTRECKE FUER ANTENNEN DER DFVLR IN OBERPFAFFENHOFEN]
Volker Stein Bonn Bundesmin. fuer Forsch. und Technol. Jan. 1974 84 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol.
(BMFT-FBW-74-01) Avail: NTIS HC $7.25; ZLDI, Munich 17.25 DM

The constructive and electrical features of the test range, for antennas in the range 0.1 to 11.0 GHz and their devices, are described. Formulas were derived to estimate the dynamic range of antenna pattern drawing. The criterions of far field condition were used to fix the maximum allowable size of transmitting and receiving antennas. The influence of the ground reflections on the accuracy of the measurements are discussed. For some special frequencies the reflection coefficient of the test range was determined. Some proposals are made for the improvement of the test range qualities. Author (ESRO)

N74-20904# New Mexico Univ., Albuquerque. Eric H. Wang Civil Engineering Research Facility.
AIRFIELD EROSION CONTROL FOR C-5A AIRCRAFT OPERATIONS Final Report, May - Jul. 1971
Robert O. Clark, Rey A. Shunk, Wayne M. McMurty, and Richard A. Weismiller Jan. 1974 30 p refs
(Contract F29601-72-C-0024; AF Proj. 683M)
(AD-774484; AFWL-TR-73-139) Avail: NTIS CSCL 01/5

A study was conducted to map the surface velocity contours of the air movement and engine exhaust produced by the C-5A aircraft during takeoff roll and rotation. This study was undertaken to determine possible causes of runway shoulder erosion. Windsleeves and smoke grenades were to determine the directional nature of the surface air movement and engine exhaust. These data were then used to determine placement of Pitot probes to measure air velocity forces. Pitot probes and static pressure gages, containing strain-type electronic sensors, were

placed along two parallel lines extending from 50 to 150 ft perpendicular to the centerline of the aircraft roll path. The entire takeoff roll was studied by conducting repeated test runs in which the aircraft breakaway point was progressively moved closer, in 1000-ft increments, to the instrumentation. (Modified author abstract) GRA

N74-20905# Naval Training Equipment Center, Orlando, Fla.
DYNAMICS REPORT FOR T-28B SIMPLIFIED FLIGHT SIMULATOR Final Report, 1965 - 1970
Moses Aronson Mar. 1973 68 p refs
(AD-774479; NAVTRAEQUIPC-IH-217) Avail: NTIS CSCL 01/3

A study was conducted to develop a method and approach by which specific characteristics of the NAA T-28B aircraft are to be simulated. This includes also the aerodynamic design data developed and needed for computer programming; aircraft equations of motion and position; simulator equations of motion and position; simulator instrument, aircraft systems, flight control and engine equations; definition of symbols, subscripts, and mathematical notation; aerodynamic coefficients and their data source; cockpit layout; and control feel design. The mathematical models for the T-28B aircraft developed under this study are applicable at a fixed gross weight of 7700 lbs and 25% c.g. location. A simplified solution for the throttle movement versus thrust horsepower output relationship was also developed. (Modified author abstract) GRA

N74-20906# Army Materials and Mechanics Research Center, Watertown, Mass.
THE STATE OF THE ART OF NONDESTRUCTIVE TESTING OF TIRES Final Report
Paul E. J. Vogel Oct. 1973 37 p
(AD-774188; AMMRC-PTR-73-9) Avail: NTIS CSCL 13/6

The work was performed to provide a source of information on all known methods of nondestructive testing of tires. The report reflects the results of a tire testing survey which has been conducted over the past year. It represents an extensive literature search, visits to Army, Navy, Air Force, Department of Transportation installations, and to the National Bureau of Standards; to three major high performance tire rebuilders; ten tire test equipment manufacturers; three major test tracks; and 22 manufacturers of new tires. (Modified author abstract) GRA

N74-20907# Calspan Corp., Buffalo, N.Y.
IN-FLIGHT TESTING OF A FLIGHT CONTROL MULTIPLEX SYSTEM IN THE NC-131 H TOTAL IN-FLIGHT SIMULATOR Final Report, 10 Jul. - 15 Dec. 1972
James N. Dittenhauser, G. J. Fabian, and Arno E. Schelhorn Mar. 1973 112 p refs
(Contract F33615-72-C-1183; AF PROJ. 8225)
(AD-774049; CALSPAN-AK-5174-F-1; AFFDL-TR-73-11) Avail: NTIS CSCL 01/3

An in-flight evaluation has been made of the effect of inserting a multiplexing device into the fly-by-wire control system of an airplane. The multiplex system was successfully used to transmit control signals in the AFFDL TIFS airplane when operating in a fly-by-wire mode. The basic characteristics which were examined are externally generated electrical noise effect of sampling rates and resolution as well as noise from the multiplex equipment itself. The data results consist of pilot evaluations and comparison of records of the flight control system performance and aircraft response with and without the multiplex units being used to transmit the signals. In addition, records of the signals entering and leaving the multiplex equipment were available for comparison so that the specific effects of insertion of the multiplex system could be identified. (Modified author abstract) GRA

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N74-20908 Missouri Univ., Rolla.
STABILITY OF THE DEVELOPING LAMINAR FLOW IN A CIRCULAR TUBE Ph.D. Thesis
Lung-mau Huang 1973 111 p
Avail: Univ. Microfilms Order No. 74-4350

An investigation is made of the linear stability of the developing laminar flow of an incompressible fluid in the entrance region of a circular tube. Both axisymmetric and non-axisymmetric small disturbances are considered in the analysis. The stability characteristics of the fully developed flow are also re-examined. The main flow velocity distribution used in the stability analysis is that from the solution of the linearized momentum equation. The governing equations for the disturbances and the boundary conditions constitute an eigenvalue problem which is solved by a direct numerical integration scheme along with an iteration technique. The solution starts with a series expansion near the center of the tube, which is followed by a fourth order Runge-Kutta integration to the tube wall. Two purification methods, a filtering scheme and an orthonormalization technique, are used to remove the 'parasitic errors" inherent in the numerical integration of the disturbance equations. Dissert. Abstr.

N74-20909 Princeton Univ., N.J.
FLOW IN FRACTURED POROUS MEDIA Ph.D. Thesis
James Otto Duguid, Jr. 1973 123 p
Avail: Univ. Microfilms Order No. 74-2325

The equations governing the flow of fluid in fractured porous media consist of Darey's law for fluid flow in the primary pores, an equation of motion for fluid flowing in the fractures, and two continuity equations. The equations are coupled by the interaction of fluid in the primary blocks with fluid in the fractures. The coupling terms, which are incorporated in the continuity equations, describe the transient flux of fluid into the fractures. The finite element Galerkin method is used to solve this coupled system of equations for transient flow in a confined leaky aquifer. Solutions are obtained for both constant discharge and step drawdown. The importance of coupling of the primary pores to the fracture system and the effect of the acceleration term in the equation of motion have been studied using this model.
Dissert. Abstr.

N74-20910 Maryland Univ., College Park.
THE HYPERSONIC TURBULENT DRAG OF SLIGHTLY BLUNTED SLENDER CONES WITH AFTERBODY ABLATION Ph.D. Thesis
William Gittings Dorsey, Jr. 1973 196 p
Avail: Univ. Microfilms Order No. 74-6734

An approximate analytical technique, involving the simultaneous solution of the momentum- and energy-integral equations for a turbulent, compressible, axisymmetric boundary layer, was developed to calculate the distributions of blowing rate, Stanton number, and local skin-friction coefficient along the subliming afterbody of a slightly blunted slender cone in hypersonic flight. In performing these calculations, it was assumed that boundary-layer transition occurred on the nonablating forward portion of the cone so that the entire subliming portion of the frustum was wetted by a turbulent boundary layer. It was further assumed that the flow external to the boundary layer was adiabatic but not isentropic, thus accounting for the entropy swallowing effect produced by finite nose bluntness. Dissert. Abstr.

N74-20911 Lehigh Univ., Bethlehem, Pa.
LAMINAR FLOW IN A TWO-DIMENSIONAL CHANNEL WITH A RIGHT ANGLE CORNER Ph.D. Thesis
1973 153 p
Avail: Univ. Microfilms Order No. 74-6707

Laminar, steady, incompressible flow in a two-dimensional channel with a right angle corner was investigated by numerical analysis and experimental measurement. The problem was used as a vehicle to compare the finite differencing method of D.N. de G. Allen and R.V. Southwell with an upwind differencing scheme. The method of Allen and Southwell was found to be somewhat more accurate, while the upwind differencing method was slightly more efficient in computer time. From the numerical solutions, zones of separated flow in the outside (reentrant) corner were found at all Reynolds numbers investigated, ranging from

20 to 500. A second separation region, extending downstream from the inside (salient) corner was found only at Reynolds numbers above 20. The extent of both separation regions increased with Reynolds number, but at a decreasing rate with increasing Reynolds number. Dissert. Abstr.

N74-20912 Lehigh Univ., Bethlehem, Pa.
INTERACTION OF TWO TURBULENT INCOMPRESSIBLE BOUNDED JETS Ph.D. Thesis
Yung Sheng Cha 1973 182 p
Avail: Univ. Microfilms Order No. 74-6678

The interaction of two incompressible, turbulent, bounded jets was investigated experimentally by using hot wire technique. Detailed measurements of velocity in the interaction zone and farther downstream were made for different values of setback, width of the control jet nozzle and control jet total pressure. Turbulence intensity profiles across the jet for various distances downstream from the stronger (power) jet nozzle exit are also reported. Angles of deflection of the power jet were determined experimentally. The aspect ratio at the power jet nozzle exit was 2, and the Reynolds numbers, based on the average power jet velocity and power nozzle width, in the tests were 12,800 and 20,000. It was found that the control jet separates from the setback wall before it reaches the power jet. The knowledge of existence of this separated flow zone is important in analytical calculation of the angle of deflection. Two analytical models, an ideal fluid model and real fluid model, were used in predicting the angle of deflection. Dissert. Abstr.

N74-20913 Toledo Univ., Ohio.
NUMERICAL STUDIES OF UNSTEADY TWO-DIMENSIONAL SUBSONIC FLOWS USING THE ICE METHOD Ph.D. Thesis
Paul Robert Wieber 1973 244 p
Avail: Univ. Microfilms Order No. 74-6937

A numerical program was developed to compute transient compressible and incompressible laminar flows in two dimensions with multicomponent mixing and chemical reaction. The algorithm used the Los Alamos Scientific Laboratory ICE (Implicit Continuous-Fluid Eulerian) method as its base. The program can compute both high and low speed compressible flows. Point by point corrections were included for the errors caused by truncating the Taylor series during finite differencing. The removal of these numerical diffusion errors stabilized computations which previously had diverged catastrophically. Multicomponent mixing and chemical reaction were incorporated using an implicit scheme and breaking the time increment into smaller steps. The mixing was computed over a small time step and was followed by reaction computations over a series of even smaller time steps. This effectively coupled the species equations and gave stable results. Dissert. Abstr.

N74-20914 Stanford Univ., Calif.
STUDIES ON THE MECHANICS AND THERMAL PROPERTIES OF SHEARED SUSPENSIONS Ph.D. Thesis
Avinoam Nir 1973 123 p
Avail: Univ. Microfilms Order No. 74-6520

Studies regarding the mechanics and kinematics of particles suspended in incompressible viscous fluids and the effective properties of sheared suspensions are presented. The creeping motion was analyzed of two arbitrary-sized touching spheres in a linear shear field. The solution to this problem constitutes one of the key steps in any future evaluation of corrections to Einstein's expression for the effective viscosity of dilute suspensions of spheres, and is also of fundamental interest in that it describes explicitly the motion of a body of revolution without fore-and-aft symmetry. The results are presented in the form of a shearing matrix (relating the force, torque and stresslet exerted by the body on the fluid, to the translation and rotation of the particle relative to the ambient field and to the rate of deformation of the undisturbed flow) from which the kinematics of a neutrally buoyant pair of touching spheres were obtained. Dissert. Abstr.

N74-20915 Stanford Univ., Calif.
A METHOD FOR THE COMPUTATION OF THE FREE MOTION OF A SLENDER BODY LOCATED IN THE INTERFERENCE FLOW FIELD OF A SECOND BODY Ph.D. Thesis
James Laurence Thompson, Jr. 1973 211 p
Avail: Univ. Microfilms Order No. 74-6561

A three-dimensional, analytical method is developed (and demonstrated) to (1) compute the loads on and flow configuration about a store while mounted on the parent aircraft in subsonic flight (below the critical Mach number), and (2) predict the trajectory of the store during the separation phase of its fall; i.e., during that portion of the trajectory when mutual aerodynamic interference forces play a dominant role. The dynamic model is presumed to be an externally-carried body, finned or unfinned, acted upon by an aircraft-mounted ejector mechanism, by a gravity field, and by aerodynamic forces. Arbitrary initial conditions (dive or climb, and ejection linear and rotational velocities) can be accommodated and the store is permitted six degrees-of-freedom. Included in this analysis are the interference effects produced by the aircraft fuselage and wings, aircraft pylon(s), store(s), and store fins. Dissert. Abstr.

N74-20916 Illinois Univ., Urbana.
ON MERK'S METHOD OF ANALYZING MOMENTUM, HEAT AND MASS TRANSFER IN LAMINAR BOUNDARY Ph.D. Thesis
Richard Olaylwola Fagbengle 1973 245 p
Avail: Univ. Microfilms Order No. 74-5561

Since its introduction in 1959, Merk's method of analyzing constant property has not received the attention it deserves. One reason is the unfortunate error which Merk himself and later Evans introduced into the governing differential equations for the universal functions associated with the method. This error has led to false statements and misleading conclusions regarding the usefulness of the procedure. Correct series expansions for the flow function f and temperature function 0 of boundary layers over a solid having a uniform surface temperature are presented. The associated universal functions for the first 4 terms of the series solutions have been evaluated and tabulated for wide ranges of the wedge variable and of the fluid Prandtl number. With the availability of these tabulations, the local friction coefficient and the heat or mass transfer rate can be readily computed, once the other stream velocity distribution is known. The nature of the convergence of the series also provides an indication of the reliability of the results. Dissert. Abstr.

N74-20917 Brown Univ., Providence, R.I.
INTERACTION OF FINITE-AMPLITUDE WAVES IN LAMINAR SHEAR FLOWS Ph.D. Thesis
Panduranga Mahendrana Gururaj 1973 178 p
Avail: Univ. Microfilms Order No. 74-3022

The development of finite-amplitude two-dimensional waves in a developing compressible wake is described through numerical calculations. The von Karman integral method employed describes the nonlinear flow development in terms of the wake centerline velocity defect, temperature excess, wake width and disturbance wave amplitude which characterize the flow. The interaction between two- and three-dimensional waves in the two-dimensional incompressible wake behind a flat plate is theoretically considered without the assumption of small amplitudes or small amplification rates. The von Karman integral method is used to describe the development of large-amplitude disturbances. The steady and fluctuating components of the flow are decomposed into their two- and three-dimensional parts. The two-dimensional mean flow is characterized by the centerline velocity defect V and the wake width. Dissert. Abstr.

N74-20918 Colorado State Univ., Fort Collins.
PREDICTION OF THE TURBULENT BOUNDARY LAYER SEPARATION Ph.D. Thesis
F.- K. Chou 1973 113 p
Avail: Univ. Microfilms Order No. 74-5411

A method for the prediction of the location of turbulent boundary layer separation is developed. The method is based on the inner and outer velocity distributions technique developed by Stratford, together with a separation criterion which applies directly to the separation position. For the inner region, the model employs the empirical one-parameter boundary layer separation profiles proposed by Sandborn and Kline. For the outer region the equivalent velocity distribution for the flow on a flat plate has been used. The resulting formula for predicting the separation position is a simple non-linear algebraic equation. The method

is tested by comparing with several well documented separation measurements. The results show a good agreement in the prediction of the position of turbulent separation. The calculated pressure rise to separation is also in good agreement with experimental results. Dissert. Abstr.

N74-20919 Lehigh Univ., Bethlehem, Pa.
WALL JET RECEIVER FLOW FIELD Ph.D. Thesis
Hsiang-sheng Shen 1973 218 p
Avail: Univ. Microfilms Order No. 74-6701

The flow field of the wall jet receiver found in bistable fluid amplifiers was studied analytically and experimentally for two values of Reynolds number (5000 and 14,000). Several distances of the receiver entrance from the nozzle exit were investigated. A range of receiver throughflow conditions and dimensionless receiver width were considered. In the experimental investigation, four different flow regimes were identified. These regimes are defined as no stall, continuous wall stall, transitory continuous wall stall, and splitter wall stall. Quantitative regime maps were constructed for a wide range of geometric and flow parameters. In addition, wall static pressure distributions, velocity profiles, and total pressure profiles were obtained inside and upstream of the receiver. In the analytical investigation, potential flow and frozen vorticity assumptions were used. The potential flow solution most accurately predicts the extent of the receiver influence region upstream of the receiver entrance, where the receiver width is the same order as the nozzle exit width. Dissert. Abstr.

N74-20920 Stanford Univ., Calif.
WAVE-INDUCED PERTURBATIONS IN A TURBULENT BOUNDARY LAYER OVER PROGRESSIVE WATER WAVES Ph.D. Thesis
Hsi- Yen Yu 1973 149 p
Avail: Univ. Microfilms Order No. 73-6576

The structures of the wave-induced perturbations in a turbulent boundary layer over a mechanically generated monochromatic wave-train were experimentally investigated. Both the amplitude and phase of the wave-induced pressure and the two wave-induced velocity components were studied. The wave-induced Reynolds stress and the power input were computed. The magnitude of each term in the governing energy-balance equation was evaluated through the measured values. A high sensitivity pressure transducer was used to measure the wave-induced pressure, while the wave-induced velocity components were measured by a quartz-coated X-array hot-film probe. These sensors were mounted on a wave-follower that followed the waveform precisely at a preselected distance from the wave surface. It was found that each of the wave-induced pressure and velocity components has certain phase and amplitude distribution with respect to the distance from the wave surface. Each also varies with the ratio of the mean wind speed and the wave celerity. Dissert. Abstr.

N74-20921 Michigan State Univ., East Lansing.
A STUDY OF THE HELIUM-JET RECOIL-TRANSPORT METHOD Ph.D. Thesis
Kenneth Lee Kosanke 1973 127 p
Avail: Univ. Microfilms Order No. 74-6076

The helium-jet recoil-transport (HeJRT) system was studied for the purposes of discovering more of the detail of the mechanism of its operation and to facilitate its further development. A series of experiments is reported on in which the operation of the HeJRT system was defined and in which the effects of varying the operating parameters of the system were recorded. This has provided an experimental basis that has allowed us to make statements on possible mechanisms of operation and the importance of certain features of the system. Of course, also included are a detailed description of the HeJRT system and sections discussing some of the extensions of HeJRT techniques that have resulted, such as those allowing the performance of on-line aqueous chemistry with the system. The initial motivations for the construction of a HeJRT system was its intended use as a subsystem in an on-line mass identification system to be used in conjunction with conventional nuclear counting experiments. Dissert. Abstr.

N74-20922# National Aerospace Lab., Amsterdam (Netherlands).
THE INFLUENCE OF THE MAIN FLOW ON THE TRANSFER FUNCTION OF TUBE-TRANSDUCER SYSTEMS USED FOR UNSTEADY PRESSURE MEASUREMENTS
H. Tijdeman and H. Bergh 19 Sep. 1972 40 p refs Presented at the Working Group on Unsteady Aerodyn. 35th AGARD Struct. and Mater. Panel Meeting, Toulouse, Sep. 1972
(NLR-MP-72023-U) Avail: NTIS HC $5.00

An experimental investigation has been performed, which revealed a considerable difference between the dynamic response characteristics of a tube-transducer system with the entrance in still air and one having an airflow across the entrance orifice. The differences observed could be explained theoretically by modifying the existing calculation model for still air in such a way, that the interaction between the periodically in- and outflow at the tube entrance and the main flow is taken into account. Application of the present knowledge investigation shows that satisfactory agreement is obtained between pressure distributions measured via tubes and via direct in situ pressure transducers. Author

N74-20923# Lockheed Missiles and Space Co., Palo Alto, Calif.
EFFECT OF NONSTATIONARY WAVES ON A CYLINDRICAL BODY IN A COMPRESSIBLE FLUID
V. D. Kubenko and N. N. Panasiuk [1973] 5 p refs Transl. into ENGLISH from Prikl. Mekh. (Kiev), v. 9, no. 12, 1973 p 77-82
Avail: NTIS HC $4.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

An exact method of solving problems of nonstationary weak shock waves interacting with cylindrical bodies is discussed. The method consists of obtaining a Volterra integral equation of the first kind for each of the vibration modes and solving it numerically. Exact values of the transition functions are determined. The nonstationary deformation of an elastic cylindrical shell with initial stresses subjected to a plane step wave is studied. The pressure on the surface of a hard cylinder subjected to step or exponentially damped plane wave is analyzed. Author

N74-20924# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE STABILITY OF CLOSED BOUNDARY LAYER SEPARATION ON REGIONS ON CONICAL BODIES OF REVOLUTION IN HYPERSONIC FLOW Ph.D. Thesis - Rhenish-Westphalian Tech. Coll.
H.- P. Kabelitz [1973] 99 p refs Transl. into ENGLISH of DFVLR, Inst. of Appl. Gasdyn., Porz, West Germany, report FB-71-77, 1971
(FB-71-77) Avail: NTIS HC $8.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Theoretical considerations yielded that a closed separation domain on concave lifting bodies can generally exhibit two different kinds of instability. A relation between the nonstationary flow phenomena observed on spike models and the numerically computed stability limits satisfies this result. On the basis of extensive agreement between wind tunnel observations and theoretical assumptions and results, the derived stability relation can certainly hold in the nucleus. It should generally be possible to assume the occurrence of nonstationary flow phenomena of the first kind (vibrations, oscillations, and related processes) and the occurrence of nonstationary flow phenomena of the second kind (pulsations) to be quantitatively correct also. Author

N74-20925*# Lockheed Missiles and Space Co., Palo Alto, Calif.
ASYMPTOTIC SOLUTION OF THE PROBLEM FOR A THIN AXISYMMETRIC CAVERN
V. V. Serebriakov [1973] 2 p refs Transl. into ENGLISH from Dopovidi Akad. Nauk Ukr. SSR (Kiev), no. 12, 1973 p 1120-1122
Avail: NTIS HC $400; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The boundary value problem which describes the axisymmetric separation of the flow around a body by a stationary infinite stream is considered. It is understood that the cavitation number varies over the length of the cavern. Using the asymptotic expansions for the potential of a thin body, the orders of magnitude of terms in the equations of the problem are estimated. Neglecting

small quantities, a simplified boundary value problem is obtained. Author

N74-20926# Institut Franco-Allemand de Recherches, St. Louis (France).
CALCULATION OF THE DETONATION OF AN EXPLOSIVE CHARGE, PART 2 [CALCUL DE LA DETONATION D'UNE CHARGE EXPLOSIVE DANS UN TUNNEL, 2EME PARTIE]
L. Bobin 1 Feb. 1973 86 p refs In FRENCH
(Contract DTEN-72.70.170)
(ISL-7/73) Avail: NTIS HC $7.50

In order to predict pressure profiles and shock wave parameters in explosive shock tubes and blast load simulators, the COMBUS computer program was developed. Using the results of this program, a second program based on the method of characteristics applied to nonstationary flow was developed for the establishment of the shock wave formation. Shock wave propagation was studied taking into account wall friction using a third computer program. Experimental results obtained using hexolite as explosive agreed with computer program results. ESRO

N74-20927# Ruhr Univ., Bochum (West Germany). Lehrstuhl fuer Stroemungsmechanik.
BOUNDARY LAYER OF HIGHER ORDER AT THE STAGNATION LINE OF A YAWING CYLINDER WITH STRONG SUCTION OF INJECTION [DIE GRENZSCHICHT HOEHERER ORDNUNG AN DER STAULINIE EINES SCHIEBENDEN ZYLINDERS MIT STARKEM ABSAUGEN ODER AUSBLASEN]
K. Gersten, J. F. Gross, and G. Boerger Bonn Bundeswehramt 1973 53 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(BMVg-FBWT-73-35) Avail: NTIS HC $5.75; Bundeswehramt 30 DM

The three-dimensional incompressible flow at the stagnation line of a yawing cylinder with suction or injection is considered. The injection of a foreign gas is included. In particular, second order effect due to surface curvature and boundary layer displacement on wall shear stress as well as on heat and mass transfer are investigated. Using the method of matched asymptotic expansions, the resulting differential equations for velocities, temperature, and concentration are solved numerically for different injection parameters. For strong suction and strong injection, differential equations again lead to singular perturbation problems, which are studied in detail. From the given solutions and from practical examples it follows that for strong injection second order effects exceed those of the first order. Author (ESRO)

N74-20928# Ruhr Univ., Bochum (West Germany). Lehrstuhl fuer Stroemungsmechanik.
COMPRESSIBLE BOUNDARY LAYER FLOW AT THREE-DIMENSIONAL STAGNATION POINT WITH INTENSIVE SUCTION OR BLOWING [DIE KOMPRESSIBLE GRENZSCHICHTSTROEMUNG AM DREIDIMENSIONALEN STAUPUNKT BEI STARKEM ABSAUGEN ODER AUSBLASEN]
K. Gersten Bonn Bundeswehramt 1973 38 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(BMVg-FBWT-73-36) Avail: NTIS HC $5.00; Bundeswehramt 30 DM

The compressible laminar boundary layer flow at a general three-dimensional stagnation point including large ratios of injection or suction on the porous surface, is considered. Wall shear stress, heat flux, and displacement thickness are determined as a function of the mass transfer parameter. The two limiting cases of intensive suction and intensive blowing lead to singular perturbation problems, which are solved by the method of matched asymptotic expansions. The asymmetry of the stagnation point flow is characterized by the ratio c of the two velocity gradients including the special cases of two-dimensional (c = 0) and axisymmetric (c - 1) stagnation point flow. For intensive suction, the wall shear stresses and the heat flux become independent of c, whereas for intensive blowing only one of the two wall shear stress components is independent of c.
Author (ESRO)

N74-20929# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Dynamik Verduennter Gase.
EXPERIMENTAL STUDY OF THE MOLECULAR BEAM DESTRUCTION BY BEAM-BEAM AND BEAM-BACKGROUND SCATTERING
U. Bossel and G. Dettleff Porz, West Ger. Aug. 1973 24 p refs Presented at the fourth Intern. Symp. on Mol. Beams, Cannes, France, 9-12 Jul. 1973
(Grants DFG-Bo-446/1; DFG-Bo-446/2)
(DLR-FB-73-116) Avail: NTIS HC $4.25; DFVLR; Porz, West Ger. 8 DM

Flow properties extraction relating molecular motion normal to streamlines of an expanding gas jet from observed intensity profiles of supersonic beams is critically assessed. The pertubation of the profile curves by various effects is studied for a helium beam. Exponential laws appear to describe scattering effects to a satisfactory degree. Author (ESRO)

N74-20930# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Dynamik Verduennter Gase.
THEORETICAL STUDY OF MOLECULAR SCATTERING IN SUPERSONIC MOLECULAR BEAMS
P. Baghuraman Porz, West Ger. Mar. 1973 62 p refs
(Contract DFG-Bo-446/2)
(DLR-FB-73-117) Avail: NTIS HC $6.25; DFVLR, Porz, West Ger. 19,70 DM

A theoretical study is made of the molecular scattering of free jets expanding in a preskimmer chamber containing skimming hardware and residual unpumped gas. The calculations are made by performing a first order iteration on the free molecule solution obtained by modeling the free jet by a sudden freeze spherical surface. The skimming hardware by a cone on an infinite wall and the background gas molecules by a Maxwellian distribution were also used. The calculations performed match experiments fairly well and establish the profound influence of the skimmer cone geometry on beam intensities. Author (ESRO)

N74-20931# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
CALCULATION OF THE LAMINAR TUBULAR FLOW OF A LIQUID WITH GAS BUBBLES [DIE BERECHNUNG DER LAMINAREN ROHRSTROEMUNG EINER FLUESSIGKEIT MIT GASBLASEN]
G. Grabitz Sep. 1973 22 p refs In GERMAN
(Rept-5/1973) Avail: NTIS HC $4.25; Max-Planck-Inst. fuer Stroemungsforsch., Goettingen, West Ger. 7,50 DM

The resistance number of a laminar two phase tubular flow was calculated in an approximative way. The flow medium consists of a viscous liquid containing relatively little homogeneously distributed gas bubbles, the diameters of which are small compared to the tube diameter. There is no mass exchange between the liquid and the gas. Calculation examples are given. ESRO

N74-20932# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
PRINCIPLES OF PHYSICS FOR MINIMIZING THE UNSTEADY BEHAVIOR AND THE NOISE GENERATION OF FLOWS [PHYSIKALISCHE PRINZIPIEN ZUR MINIMIERUNG DES INSTATIONAEREN VERHALTENS UND DER GERAEUSCHERZEUGUNG VON STROEMUNGEN]
G. E. A. Meier and W. J. Hiller Sep. 1973 24 p In GERMAN
(Rept-11/1973) Avail: NTIS HC $4.25; Max-Planck-Inst. fuer Stroemungsforsch., Goettingen, West Ger. 8 DM

Physical principles were formulated, which allow a reduction of the nonsteady flow behavior, and consequently a reduction of noise generation in flow machines. The principle of low Reynolds number accomplishes a viscous, steady flow in the flow machine structure. The principle of avoiding discontinuity surfaces prevent turbulent mixing at higher Reynolds numbers. The principle of changing a characteristics dimension of the sound generating flow area allows a reduction of the energy produced and a change to different frequency ranges. The effectiveness of these principles was demonstrated on throttling members, which reduce the noise intensity from one tenth to one thousandth. ESRO

N74-20933# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
TURBULENCE INVESTIGATIONS IN A FREE JET FLOW Ph.D. Thesis - Goettingen Univ., West Ger. [TURBULENZUNTERSUCHUNGEN IN EINEM WASSERFREISTRAHL MITTELS KORRELATION DER PHASENSCHWANKUNGEN ZWEIER GEKREUZTER ULTRASCHALLBUENDEL]
F. Albers and H. Stiewitt Dec. 1973 70 p refs In GERMAN; ENGLISH summary
(Rept-13/1973) Avail: NTIS HC $6.50; Max-Planck-Inst. fuer Stroemungsforsch., Goettingen, West Ger. 18.30 DM

By cross correlation of the phase-demodulated ultrasonic signals of two crossed ultrasonic beams, the convection velocity of turbulence elements was measured at a constant Reynolds number, in a round water jet, propagating in the x-direction. The convection velocity is compared with the mean flow velocity obtained by measurements with a Pitot tube. Ultrasonic beam arrays are given which permit measurement of the integral length scales L sub y and L sub z, as well as a characteristic eddy life time and the local intensity of the velocity fluctuations in the y- and z-directions (y- and z-directions are normal to the jet axis). The measurement methods given can also be applied to other turbulence fields when the turbulence is statistically stationary, the integral length scales L sub y and L sub z are dependent only on x, and a main flow velocity normal to the plane of the ultrasonic beams exists. Author (ESRO)

N74-20934# Ballistic Research Labs., Aberdeen Proving Ground, Md.
SEPARATION AND REATTACHMENT NEAR SQUARE PROTUBERANCES IN LOW REYNOLDS NUMBER COUETTE FLOW
Clarence W. Kitchens, Jr. Jan. 1974 41 p refs
(DA Proj. 1T0-61101-A-91A)
(AD-773663; BRL-1695) Avail: NTIS CSCL 20/4

Numerical solutions of the steady-state Navier-Stokes equations are obtained which describe flow past a square protuberance immersed in a plane Couette flow. The numerical solutions are illustrated with velocity vector plots, and plots of streamlines and vorticity contours in the flow field for Reynolds numbers between one and 200, based on plate velocity and protuberance height. A small separation bubble is predicted upstream of the protuberance with length and height almost independent of Reynolds number. The downstream separation bubble has a height always less than the protuberance height, but a length which increases almost linearly with Reynolds number reaching more than twenty-five protuberance heights at Re = 200. The flow perturbations caused by the protuberance are shown to persist far downstream of the protuberance at Re = 100 and 200. Author (GRA)

N74-20935# Naval Civil Engineering Lab., Port Hueneme, Calif.
A FLUIDIC SYSTEM FOR MIXING TWO FLUIDS Final Study
D. Pal Dec. 1973 73 p refs
(AD-774486; NCEL-TN-1314) Avail: NTIS CSCL 13/7

The development of a double leg elbow proportional fluid amplifier to handle 5.85 gpm of water flow rate is described in detail. The amplifier has linear output flow characteristics with a gain of 50 and can switch flow from one output to the other completely. Based upon the experimental results, analytical expressions are developed which clearly show the effects of the active and passive legs flow parameters, the control flow and the size and location of the output ports on amplifier's performance and they can be used in designing an amplifier of a desired flow capacity. Analytical expressions to predict the performance of the amplifier are also given. A mixing element comprised of two double leg elbow amplifiers stacked together to mix two fluids was designed and tested successfully. Author (GRA)

N74-20936# Ohio State Univ., Columbus. Dept. of Aeronautical and Astronautical Engineering.
AN INVESTIGATION OF HYPERSONIC VISCOUS MERGED FLOW Final Report, 1 Oct. 1966 - 30 Sep. 1973
Ting Y. Li Nov. 1973 54 p refs
(Contract N00014-67-A-0232-0001; NR Proj. 061-138)
(AD-774726) Avail: NTIS CSCL 20/4

The report deals with the hypersonic Rayleigh problem. The exact Navier-Stokes equations are used in the formulation. The perfect gas model with gamma and sigma constant ratio of specific heats and Prandtl number, respectively is assumed. The case of an insulated plate under impulsive motion at a limiting hypersonic Mach number is considered. Numerical solutions based on an explicit scheme and a Crank-Nicolson scheme have been obtained within the hypersonic viscous merged layer over the plate surface. These numerical results are compared with existing analytical and empirical results. Difficulties encountered in the numerical calculations and their remedies are briefly outlined. (Modified author abstract) GRA

N74-20937# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ATTENUATION OF WEAK SHOCK WAVES IN A NON-UNIFORM REGION M.S. Thesis
Raymond L. Ehcart Dec. 1973 88 p refs
(AD-774392; GAM/AE/73A-7) Avail: NTIS CSCL 20/4

The results of an experimental study of the attenuation of a shock wave traveling through a non-uniform region were compared to the results of a numerical solution developed from the continuity, momentum, energy, and Rankine-Hugoniot equations using G. B. Whitham's rule. The region of non-uniformity consisted of a converging section which was porous. The angles of convergence tested were 0, 4, and 6-degrees having a maximum porosity of approximately 44%. The 0- and 4-degree channel had a height of 3/4 in. and the 6-degree channel had an equivalent height of 1-1/2 in. with the porous section of both convergent channels being 4 in. long and the 0-degree channel 3-1/2 in. long. (Modified author abstract) GRA

N74-20938# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
HYPERSONIC FLOW OVER A FLAT PLATE M.S. Thesis
William M. Tuck, Jr. Nov. 1973 82 p refs
(AD-774386; GAM/AE/73A-18) Avail: NTIS CSCL 20/4

The purpose of the study was to determine the performance of the AFIT hypersonic shock tunnel and to demonstrate the use of heat transfer gages and miniature pressure transducers in the facility by analyzing the flow over a flat plate model. The performance of the tunnel was determined by calibrating the driven tube and test section. Calibration of the driven tube consisted of measuring driven shock speed, pressure ratio across the driven shock, and pressure after shock reflection. The data obtained were then plotted as a set of performance curves. The test section performance was determined from an impact rake survey of the nozzle exit. The Mach number of the flow was found to be 11.10 and the diameter of the nozzle inviscid core nominally 18 in. (Modified author abstract) GRA

N74-20939# California Inst. of Tech., Pasadena.
AN EXPERIMENTAL INVESTIGATION OF A TWO-DIMENSIONAL, SELF-SIMILAR, SUPERSONIC TURBULENT MIXING LAYER WITH ZERO PRESSURE GRADIENT Final Report, 1 Jul. 1972 - 30 Sep. 1973
Hideo Ikawa and Toshi Kubota 26 Dec. 1973 33 p refs
(Contract DAHC04-72-C-0038)
(AD-774316; AROD-10863-1-E) Avail: NTIS CSCL 20/4

The effect of compressibility on the mixing layer was investigated at Mach number 2.47. Pitot pressure, static pressure and hot-wire surveys were made to investigate the mean flow and the fluctuation quantities. Similarities between supersonic and incompressible mixing layers are observed in normalized velocity profile, normalized power spectral density distribution and convection velocity distribution. Spreading rate, normalized shear stress and velocity fluctuation were found to be appreciably smaller than the respective incompressible results e.g., the momentum thickness growth rates are 0.0073 and 0.035 for supersonic and incompressible flows, respectively. The difference between free and wall-bounded mixing layers is discussed. Development of turbulence structure of mixing layer with increasing Reynolds number was also investigated.
Author (GRA)

N74-20940# Tennessee Technological Univ., Cookeville. Dept. of Engineering Science.
FLOW OF AN AIR-RAINDROP SUSPENSION PAST A

SPHERE
John Peddieson, Jr. and Chung- Hsein Lyu Jan. 1974 45 p refs
(Contract DAAH01-72-C-0375)
(AD-774352; TTU-ES-74-2) Avail: NTIS CSCL 20/4

In the present report the governing differential equations associated with a continuum theory of the motion of air-raindrop suspensions are solved to determine the dispersed-phase flow field for supersonic flow past a sphere. The equations are solved numerically by beginning at the forward stagnation line and marching downstream. Results of these calculations are displayed graphically and employed to illustrate interesting features of two-phase flows past blunt bodies. Also discussed are approximate analytical solutions valid for thin shock layers and the importance of nonnegligible dispersed-phase volume fractions and distributions of drop sizes within the dispersed phase.
Author (GRA)

N74-20941# Stanford Research Inst., Menlo Park, Calif.
NUMERICAL SIMULATION TURBULENCE
K. M. Case, F. W. Perkins, F. J. Dyson, E. A. Frieman, and C. E. Grosch Nov. 1973 66 p refs
(Contract DAHC15-73-C-0370; ARPA Order 2504)
(AD-774161; SRI-JSR-73-3) Avail: NTIS CSCL 20/4

Turbulent flows play a major role in many problems of great practical interest. In the report the authors consider whether the advent of a new generation of computers (Illiac IV, Star, ASC) makes feasible a numerical attack on turbulence by direct integration of the Navier-Stokes equations. GRA

N74-20942# Illinois Univ., Urbana. Coordinated Science Lab.
A STUDY OF FINITE DIFFERENCE METHODS FOR SOLVING VISCOUS AND INVISCID FLOWS M.S. Thesis
James Richard Flood Jun. 1973 38 p refs
(Contract DAAB07-72-C-0259; N00014-67-A-0305-0019)
(AD-774320; R-615; UILU-ENG-73-2217) Avail: NTIS CSCL 20/4

The basic one-dimensional, time dependent gas dynamic equations were solved numerically using a number of second order schemes for the inviscid problems and an implicit fourth order method for both viscous and inviscid problems. The accuracy of the numerical solutions was evaluated by comparison with analytic solutions in most cases. The inviscid problems included accelerating piston, shock wave, compression wave, and isentropic expansion flows. The second order schemes used were MacCormack, Moretti, Richtmyer, Lax-Wendroff, Brailovskaya, Cheng-Allen, Crank-Nicholson, and Dufort-Frankel. Of these, MacCormack's scheme was found to give the best results for the problems considered. GRA

N74-20943# McDonnell-Douglas Astronautics Co., Titusville, Fla.
INVESTIGATION OF THE EFFECTIVENESS OF CYCLONE SEPARATORS ON FLUIDIC POWER SUPPLIES Final Report
W. J. Westerman, Jr., R. E. Wright, and G. W. Roe Dec. 1973 74 p refs
(Contract DAAG39-73-C-0100)
(AD-774370; L0243) Avail: NTIS CSCL 13/7

The report presents the results of a program to evaluate the effectiveness of cyclone separators in conditioning solid propellant exhaust products and turbine engine bleed gasses for use as fluidic system power supplies. GRA

N74-21251 Joint Publications Research Service, Arlington, Va.
SOME RESULTS OF NUMERICAL SIMULATION OF PROCESSES WHEN A PARTICLE SYSTEM FALLS IN A VISCOUS MEDIUM
S. L. Lebedev and O. N. Sabiyeva *In its* Meteorol. and Hydrol., No. 1, 1974 (JPRS-61729) 11 Apr. 1974 p 120-124 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 1, 1974 p 84-86 (For availability see N74-21239 12-20)

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N74-20944 Rensselaer Polytechnic Inst., Troy, N.Y.
ENVIRONMENTAL-ACOUSTICS MODELS FOR A MOVING OCEAN WITH EMPHASIS ON GEOSTROPHIC EFFECTS Ph.D. Thesis
Edward Richard Franchi 1974 167 p
Avail: Univ. Microfilms Order No. 74-51-37

Ray geometry, travel time, and spreading loss are examined for a moving medium. The sound speed and current are both depth-variable, and the current direction is fixed in space. For a linear sound speed and current, ray geometry is investigated and an approximate solution is obtained which leads to helical paths. For a bottom-mounted source and receiver in the vertical plane of the current, the linear model is used to investigate ray geometry, travel time, spreading loss, and the acoustic field associated with refracted/bottom-reflected (RBR) transmissions. It is shown that the effects of current gradients and bottom currents on the phase and amplitude of the acoustic field are important and cannot be ignored. Further, long-term time variations in the current gradient are shown to cause much shorter-term variations in phase and amplitude. Dissert. Abstr.

N74-20945 Colorado State Univ., Fort Collins.
AN AIRCRAFT INVESTIGATION OF TURBULENCE IN THE LOWER LAYERS OF A MARINE BOUNDARY LAYER Ph.D. Thesis
Robert Louis Grossman 1973 195 p
Avail: Univ. Microfilms Order No. 74-5422

The results of an aircraft investigation of turbulence within the lower subcloud layer of a fair weather tradewind regime point to the fact that in the near surface layer the physical mechanisms predominent in the transport of latent heat differ from those which transport momentum and sensible heat. A model is presented for the surface layer in which it is proposed that the latent heat is transported primarily by small scale phenomena such as plume or bubble structure while the momentum and sensible heat flux are due to a mixture of small scale phenomena and some larger scale organization. Comparison of the measurements made in this experiment with other independent measurements made over land and ocean proved very encouraging. It was found that characteristics associated with momentum and sensible heat transport, such as flux value, standard deviation, and correlation coefficient decreased with decreasing stability. The same characteristics for latent heat flux were nearly constant and independent of stability.
Dissert. Abstr.

N74-20946 Louisiana State Univ., Baton Rouge.
DYNAMICS OF THE WATER SURFACE IN A BAR-BUILT ESTUARY Ph.D. Thesis
Bjorn Kjerfue 1973 103 p
Avail: Univ. Microfilms Order No. 74-7233

Continuous measurements of water level, wind speed and direction, and atmospheric pressure during a 20-day period in July 1972, provided insight into the dynamics of Caminada Bay, an extremely shallow, bar-built Louisiana estuary. The water surface elevation was recorded at three locations in the bay, a geopotential surface was established, and the time-dependent variations of a slope vector along the surface gradient were computed. It was found that the instantaneous slope vector either oscillated or rotated in the horizontal plane as a function of time, primarily due to tidal input through two major entrances but modified by the wind surface stress. Under simplifying assumptions, a set of linearized equations was solved analytically, giving good agreement between observed and simulated slope magnitudes and directions. Dissert. Abstr.

N74-20947 Texas Univ., Austin.
COMPLEX REFRACTIVE INDEX OF ICE FOG AT A RADIO WAVELENGTH OF 3mm Ph.D. Thesis
John Windsor Perry 1973 209 p

Avail: Univ. Microfilms Order No. 74-5310

An investigation of the complex index of refraction a 97 GHz for low temperature ice fogs was carried out over the temperature interval -30 C to -48 C. These measurements were carried out in the laboratory in a specially constructed environmental chamber of approximately 70 cubic foot volume. A Fabry-Perot semi-confocal cavity, consisting of a 6-inch diameter aluminum spherical mirror of a 72 inch radius of curvature and a copper flat plate separated 36 inches from the spherical mirror, was used to make the electromagnetic measurements. Waveguide feeds brought through the back of the flat plate coupled energy into and out of the cavity. The complex index of refraction of the ice fog medium in the fields of the Fabry-Perot resonant cavity were found from the change in the resonant frequency and amplitude response of the cavity when the fog was present. The fog could be controlled and introduced to the cold chamber from the external steam source, and a blower located inside the chamber was used to mix and dissipate the fog as desired.

Dissert. Abstr.

N74-20948*# Texas Instruments, Inc., Dallas.

ERTS-1 IMAGERY USE IN RECONNAISSANCE PROSPECTING: EVALUATION OF COMMERCIAL UTILITY OF ERTS-1 IMAGERY IN STRUCTURAL RECONNAISSANCE FOR MINERALS AND PETROLEUM Final Report, 20 Aug. 1972 - 23 Oct. 1973

D. F. Saunders, G. E. Thomas, Principal Investigators, F. E. Kinsman, and D. F. Beatty Dec. 1973 162 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(Contract NAS5-21796)

(E74-10345; NASA-CR-136857; U1-702700-F) Avail: NTIS HC $11.25 CSCL 08G

The author has identified the following significant results. This study was performed to investigate applications of ERTS-1 imagery in commercial reconnaissance for mineral and hydrocarbon resources. ERTS-1 imagery collected over five areas in North America (Montana; Colorado; New Mexico-West Texas; Superior Province, Canada; and North Slope, Alaska) has been analyzed for data content including linears, lineaments, and curvilinear anomalies. Locations of these features were mapped and compared with known locations of mineral and hydrocarbon accumulations. Results were analyzed in the context of a simple-shear, block-coupling model. Data analyses have resulted in detection of new lineaments, some of which may be continental in extent, detection of many curvilinear patterns not generally seen on aerial photos, strong evidence of continental regmatic fracture patterns, and realization that geological features can be explained in terms of a simple-shear, block-coupling model. The conculsions are that ERTS-1 imagery is of great value in photogeologic/geomorphic interpretations of regional features, and the simple-shear, block-coupling model provides a means of relating data from ERTS imagery to structures that have controlled emplacement of ore deposits and hydrocarbon accumulations, thus providing a basis for a new approach for reconnaissance for mineral, uranium, gas, and oil deposits and structures.

N74-20949*# National Aeronautics and Space Administration. Mississippi Test Facility, Bay Saint Louis.

[SATELLITE REMOTE SENSING AND AUTOMATIC DATA TECHNIQUES FOR CHARACTERIZATION OF WETLANDS AND COASTAL MARSHLANDS] Progress Report, 1 Jan. - 28 Feb. 1974

Robert H. Cartmill, Principal Investigator 11 Mar. 1974 2 p ERTS

(E74-10408; NASA-TM-X-70065) Avail: NTIS HC $4.00 CSCL 08H

There are no author-identified significant results in this report.

N74-20950*# Geological Survey, Menlo Park, Calif.

IDENTIFICATION OF GEOSTRUCTURES OF CONTINENTAL CRUST PARTICULARLY AS THEY RELATE TO MINERAL RESOURCE EVALUATION Progress Report, 1 Jul. - 31 Dec. 1973

George Gryc, Principal Investigator and Ernest H. Lathram 28 Feb. 1974 41 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(NASA Order S-70243-AG-1)

(E74-10416; NASA-CR-137275) Avail: NTIS HC $5.25 CSCL 08G

The author has identified the following significant results. New mineral deposits have recently been discovered in eastern Alaska through application of a hypothesis very similar to one developed in interpretation of Nimbus and ERTS-1 imagery in this investigation, that mineral deposits may be spatially related to a set of crustal linears. The discovery affirms the validity of this hypothesis and provides an additional exploration rationale to the mineral industry. A regional lineation in lakes near Umiat in northern Alaska, suspected to reflect structures in basement and suggesting areas of possible potential for new petroleum exploration, is found to cover a much larger area than previously suspected east of the Colville River, increasing the area of interest. Further application of this same imagery exists in that environmental scars to the tundra resulting from previous ground exploration, if of large size, can be recognized and their natural revegetation monitored by use of ERTS imagery. New geologic data obtained from ERTS-1 images of lowland areas of western northern Alaska facilitates assessing the petroleum potential of this area. Use of the images in field mapping permitted extrapolation of field observations. Mosaics of ERTS-1 images have provided additional data on regional linear sets and on other regional fault trends possibly related to mineralized areas.

N74-20951*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.

REPORT OF OPTICAL GROUND TRUTH MEASUREMENTS FOR 5 AUGUST 1973, TEST SITE NUMBER 548532, IN SUPPORT OF THE SKYLAB MULTISPECTRAL SCANNER Special Report, Mar. 1973 - Jun. 1974

Frederick J. Thomson, Principal Investigator, D. Zuk, and G. Suits Jan. 1974 107 p EREP

(Contract NAS9-13272)

(E74-10423; NASA-CR-137282; ERIM-101700-10-X) Avail: NTIS HC $8.50 CSCL 08B

There are no author-identified significant results in this report.

N74-20952*# Calspan Corp., Buffalo, N.Y.

S190 INTERPRETATION TECHNIQUES DEVELOPMENT AND APPLICATION TO NEW YORK STATE WATER RESOURCES Quarterly Report, 1 Dec. 1973 - 28 Feb. 1974

Kenneth R. Piech, Principal Investigator 28 Feb. 1974 3 p EREP

(Contract NAS9-13336)

(E74-10424; NASA-CR-137350; QR-4) Avail: NTIS HC $4.00 CSCL 08H

There are no author-identified significant results in this report.

N74-20953*# Ecosystems International, Inc., Gambrills, Md.

THE PRACTICAL UTILIZATION OF REMOTE SENSING TECHNOLOGY FOR THE MANAGEMENT AND CONSERVATION OF NATURAL RESOURCES. PART 1: CROP FORECASTING

Peter A. Castruccio and Harry L. Loats, Jr. Mar. 1974 64 p refs Sponsored by NASA ERTS

(E74-10425; NASA-CR-137351) Avail: NTIS HC $6.25 CSCL 02C

There are no author-identified significant results in this report.

N74-20954*# Dartmouth Coll., Hanover, N.H. Dept. of Geography.

LAND USE IN NORTHERN MEGALOPOLIS Bimonthly Progress Report, Feb. - Mar. 1974

Robert B. Simpson, Principal Investigator 29 Mar. 1974 2 p refs ERTS

(Contract NAS5-21749)

(E74-10426; NASA-CR-137352; BMPR-9) Avail: NTIS HC $4.00 CSCL 08B

There are no author-identified significant results in this report.

N74-20955*# Cornell Univ., Ithaca, N.Y. New York State Coll. of Agriculture and Life Sciences.
EVALUATION OF SKYLAB IMAGERY AS AN INFORMATION SERVICE FOR INVESTIGATING LAND USE AND NATURAL RESOURCES (SKYLAB) Progress Report, 1-31 Mar. 1974
Ernest E. Hardy, Principal Investigator 31 Mar. 1974 2 p EREP
(Contract NAS9-13364)
(E74-10428; NASA-CR-137364) Avail: NTIS HC $4.00 CSCL 08B

There are no author-identified significant results in this report.

N74-20956*# California Earth Science Corp., Santa Monica.
FAULT TECTONICS AND EARTHQUAKE HAZARDS IN THE PENINSULAR RANGES, SOUTHERN CALIFORNIA Monthly Progress Report, Mar. 1974
Paul M. Merifield, Principal Investigator 5 Apr. 1974 2 p EREP
(Contract NAS2-7698)
(E74-10429; NASA-CR-137365; MPR-10) Avail: NTIS HC $4.00 CSCL 08E

There are no author-identified significant results in this report.

N74-20957*# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
SEDIMENT PATTERN CORRELATION WITH INFLOW AND TIDAL ACTION Progress Report, 1 Jan. - 28 Feb. 1974
Warren E. Grabau, Principal Investigator 28 Feb. 1974 2 p refs ERTS
(NASA Order S-70259-AG)
(E74-10430; NASA-CR-137377) Avail: NTIS HC $4.00 CSCL 08C

There are no author-identified significant results in this report.

N74-20958*# Naval Research Lab., Washington, D.C.
TERRAIN PROPERTIES AND TOPOGRAPHY FROM SKYLAB ALTIMETRY Monthly Progress Report, Mar. 1974
Allan Shapiro, Principal Investigator 22 Apr. 1974 1 p EREP
(NASA Order T-4716-B)
(E74-10431; NASA-CR-137378) Avail: NTIS HC $4.00 CSCL 08E

There are no author-identified significant results in this report.

N74-20959*# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
[MICROWAVE RADIOMETER-SCATTEROMETER MEASUREMENTS] Monthly Progress Report, 1-31 Dec. 1973
R. K. Moore, Principal Investigator and Arun Sobti 7 Mar. 1974 2 p ref EREP
(Contract NAS9-13331)
(E74-10432; NASA-CR-137379) Avail: NTIS HC $4.00 CSCL 14B

There are no author-identified significant results in this report.

N74-20960*# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
[MICROWAVE RADIOMETER-SCATTEROMETER MEASUREMENTS] Monthly Progress Report, 1-30 Nov. 1973
R. K. Moore, Principal Investigator and Arun Sobti 7 Mar. 1974 2 p EREP
(Contract NAS9-13331)
(E74-10433; NASA-CR-137380) Avail: NTIS HC $4.00 CSCL 14B

There are no author-identified significant results in this report.

N74-20961*# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
[MICROWAVE RADIOMETER-SCATTEROMETER MEASUREMENTS] Monthly Progress Report, 1-28 Feb. 1974
R. K. Moore, Principal Investigator and Arun Sobti 8 Mar. 1974 2 p ref EREP
(Contract NAS9-13331)
(E74-10434; NASA-CR-137381) Avail: NTIS HC $4.00 CSCL 14B

There are no author-identified significant results in this report.

N74-20962*# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
[MICROWAVE RADIOMETER-SCATTEROMETER MEASUREMENTS] Monthly Progress Report, 1-31 Jan. 1974
R. K. Moore, Principal Investigator and Arun Sobti 8 Mar. 1974 2 p EREP
(Contract NAS9-13331)
(E74-10435; NASA-CR-137382) Avail: NTIS HC $4.00 CSCL 14B

There are no author-identified significant results in this report.

N74-20963*# East Anglia Univ., Norwich (England). School of Environmental Sciences.
DESIGN AND EVALUATION OF A COMPUTER BASED SYSTEM TO MONITOR AND GENERALISE, BY AREAS, DATA FROM ERTS PRECISION IMAGERY TAPES Progress Report, 23 Jul. 1973 - 22 Jan. 1974
Keith M. Clayton, Principal Investigator Mar. 1974 89 p refs Sponsored by NASA ERTS
(E74-10436; NASA-CR-137387) Avail: NTIS HC $7.50 CSCL 08B

There are no author-identified significant results in this report.

N74-20964*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
EMISSION AND REFLECTION FROM HEALTHY AND STRESSED NATURAL TARGETS WITH COMPUTER ANALYSIS OF SPECTRORADIOMETRIC AND MULTISPECTRAL SCANNER DATA
Ravindra Kumar and LeRoy F. Silva Dec. 1973 238 p refs (Grant NGL-15-005-112)
(NASA-CR-137427; LARS-072473; TR-EE-73-37) Avail: NTIS HC $15.00 CSCL 06C

Special emphasis was on corn plants, and the healthy targets were differentiated from stressed ones by remote sensing. Infrared radiometry of plants is reviewed thoroughly with emphasis on agricultural crops. Theory and error analysis of the determination of emittance of a natural target by radiometer is discussed. Experiments were conducted on corn (Zea mays L.) plants with long wavelength spectroradiometer under field conditions. Analysis of multispectral scanner data of ten selected flightlines of Corn Blight Watch Experiment of 1972 indicated: (1) There was no regular pattern of the mean response of the higher level/levels blighted corn vs. lower level/levels blighted corn in any of the spectral channels. (2) The greater the difference between the blight levels, the more statistically separable they usually were in subsets of one, two, three and four spectral channels.
Author

N74-20965*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
AIRBORNE MULTISPECTRAL DATA COLLECTION Final Report, 28 Feb. 1969 - 31 Dec. 1973
Philip G. Hasell, Jr. Jan. 1974 57 p refs
(Contract NAS9-9304)
(NASA-CR-137418; ERIM-190901-1-F) Avail: NTIS HC $6.00 CSCL 08B

Multispectral mapping accomplishments using the M7 airborne scanner are summarized. The M7 system is described and overall results of specific data collection flight operations since June 1971 are reviewed. A major advantage of the M7 system is that all spectral bands of the scanner are in common spatial registration, whereas in the M5 they were not. Author

N74-20966*# Kanner (Leo) Associates, Redwood City, Calif.
ERRORS IN MEASUREMENT OF UNDERWATER IRRADIANCE IN THE SEA
V. I. Degtyarev, Yu. Ye. Ochakovskiy, and V. N. Pelevin Washington NASA Sep. 1973 15 p refs Transl. into ENGLISH from the book "Optika Okeana i Atmofery" Nauka Press, Leningrad, 1972 p 104-113

(Contract NASw-2481)
(NASA-TT-F-14779) Avail: NTIS HC $4.00 CSCL 08J

The experience of practical underwater irradiance measurements performed at the Institute of Oceanography of the U.S.S.R. An estimate is given of permissible errors, and certain recommendations for the most effective means of measurement are formulated. Author

N74-20967# Joint Publications Research Service, Arlington, Va.
LEGAL ASPECTS OF MANNED SPACEFLIGHT AND REMOTE SENSING OF THE ENVIRONMENT
29 Mar. 1974 22 p refs Transl. into ENGLISH from Sov. Gosudarstvo i Pravo (Moscow), no. 1, 1972 p 121-124 and no. 4, 1972 p 111-115
(JPRS-61614) Avail: NTIS HC $4.25

International cooperation and law aspects of space exploration and earth resources mapping by manned orbital space stations are considered. For individual titles, see N74-20968 through N74-20969.

N74-20968 Joint Publications Research Service, Arlington, Va.
MANNED SPACE STATIONS IN CIRCUMTERRESTRIAL ORBITS **c30**
A. I. Rudev and V. G. Emin *In its* Legal Aspects of Manned Spaceflight and Remote Sensing of the Environment (JPRS-61614) 29 Mar. 1974 p 1-10 refs Transl. into ENGLISH from Sov. Gosudarstvo i Pravo (Moscow), no. 4, 1972 p 111-115 (For availability see N74-20967 12-13)

Orbital stations can be used as a base for servicing automatic orbiting vehicles, for training cosmonauts prior to flights into the solar system, for space communications, and also as cosmodromes for the launching of vehicles to other planets. International law aspects of the use of circumterrestrial manned space stations and also their juridical status are elaborated. Author

N74-20969 Joint Publications Research Service, Arlington, Va.
ENVIRONMENTAL STUDIES FROM SPACE
V. S. Vereshchetin *In its* Legal Aspects of Manned Spaceflight and Remote Sensing of the Environment (JPRS-61614) 29 Mar. 1974 p 11-19 refs Transl. into ENGLISH from Sov. Gosudarstvo i Pravo (Moscow), no. 1, 1972 p 121-124 (For availability see N74-20967 12-13)

Earth surface mapping by manned orbital space stations for studying natural resources requires legislation that provides guarantees for protecting the sovereign rights of states to their natural wealth against the encroachments of foreign interests. Juridical aspects of space law are discussed that pertain to an international agreement on activities of remote sensing satellites, and the formulation of a final juridical regime for the study of environment from space. G.G.

N74-20970# Joint Publications Research Service, Arlington, Va.
TECTONIC, GEOLOGICAL STUDIES OF EARTH USING SPACE PHOTOGRAPHS
27 Mar. 1974 28 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Geol. i Razvedka (Moscow), no. 7, 1973 p 67-74, 140-149
(JPRS-61581) Avail: NTIS HC $4.50

An article on interpreting the tectonic structure of young epiplatform mountain formations on earth photographs from space is presented along with an article on special methods for the remote study of the earth for geological purposes. For individual titles, see N74-20971 through N74-20972.

N74-20971 Joint Publications Research Service, Arlington, Va.
INTERPRETABILITY OF TECTONIC STRUCTURES OF REGIONS OF YOUNG EPIPLATFORM MOUNTAIN FORMATION ON SPACE PHOTOGRAPHS OF THE EARTH (IN THE EXAMPLE OF THE SOUTHWESTERN TIEN SHAN)
V. I. Makarov *In its* Tectonic, Geol. Studies of Earth using Space Photo. (JPRS-61581) 27 Mar. 1974 p 1-11 refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Geol. i Razvedka (Moscow), no. 7, 1973 p 67-74 (For availability see N74-20970 12-13)

The feasibility of using images of the earth obtained from space for studying the tectonics of young epiplatform mountains is analyzed for the Tien Shan. The morphology, structures, and development of the recent tectonic depressions are discussed. The correlation of deformations noted on space photographs with known dislocations is considered evidence of the possibility for structural-geomorphogical analysis. F.O.S.

N74-20972 Joint Publications Research Service, Arlington, Va.
SPECIAL METHODS FOR THE REMOTE STUDY OF THE EARTH FOR GEOLOGICAL PURPOSES
A. G. Ryabukhin *In its* Tectonic, Geol. Studies of Earth using Space Photo. (JPRS-61581) 27 Mar. 1974 p 12-25 refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Geol. i Razvedka (Moscow), no. 7, 1973 p 140-149 (For availability see N74-20970 12-13)

Methods are discussed for the remote registration of the invisible electromagnetic spectrum of the earth's radiation for studying geological structures. The methods discussed include spectrometry, infrared, and radar. F.O.S.

N74-20973*# Stanford Univ., Calif. Inst. for Plasma Research.
GEOMAGNETIC RESPONSES TO THE SOLAR WIND AND SOLAR ACTIVITY
Leif Svalgaard Dec. 1973 71 p refs
(Grant NGR-05-020-559; Contract N00014-67-A-0112-0068; Grant NSF GA-31138)
(NASA-CR-137408; SU-IPR-555) Avail: NTIS HC $6.75 CSCL 08N

The geomagnetic response to the dynamic solar wind is discussed. The importance of electric fields is stressed and the magnetospheric convection of plasma and frozen-in magnetic field lines under the influence of large-scale magnetospheric electric fields is outlined. The energy input of the solar wind to the magnetosphere and upper atmosphere is discussed in terms of the reconnection model where interplanetary of the magnetosphere. The model emphasizes the importance of the interplanetary magnetic field and especially the north-south component, because the merging efficiency is strongly dependent on the amount of southward flux. The solar sector structure with its organized magnetic field and embedded high speed plasma streams is identified as the source of the recurrent geomagnetic disturbances while flare-associated interplanetary shock waves are the source of most violent and sporadic geomagnetic storms. An appendix contains numerical estimates of some relevant physical quantities related to intensities of fields and currents in the magnetosphere and the ionosphere. Author

N74-20974*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DERIVATION OF A THREE DIMENSIONAL NUMERICAL WATER QUALITY MODEL FOR ESTUARY AND CONTINENTAL SHELF APPLICATION
Malcolm Spaulding [1973] 24 p refs
(NASA-TM-X-71930) Avail: NTIS HC $4.25 CSCL 08H

A derivation is given for a three dimensional mass transport equation which is appropriate for numerical modeling of estuary and continental shelf water quality variations for both the time dependent and steady state cases. A finite difference approximation to the derived equation is presented and a solution scheme for the resulting equations outlined. Preliminary results are obtained using the model for the extremely simple problems which have analytical solutions. The numerical model, as presented, will provide a scheme to study water quality problems in coastal waters for both steady state and time dependent cases. Author

N74-20975*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
ELECTRIC AND MAGNETIC FIELD OBSERVATIONS DURING A SUBSTORM OF 24 FEBRUARY 1970 Progress Report
D. A. Gurnett and S.-I. Akasofu (Alaska Univ., Fairbanks) Feb. 1974 20 p refs Submitted for publication
(Contracts NAS5-10625; NAS1-8141; NAS1-2973; Grant NGR-16-001-043; Contract N00014-68-A-0196-0009; Grant NSF GA-363873X)
(NASA-CR-137412; U-of-Iowa-74-13) Avail: NTIS HC $4.00

CSCL 04A

A series of electric field measurements is reported which was obtained from the Injun 5 satellite along with a simultaneous magnetic disturbance observed in the interplanetary medium and on the ground during a magnetic substorm. The substorm analyzed took place on February 24, 1970. Prior to the onset of the substorm a greatly enhanced anti-sunward plasma flow was observed over the polar cap. The enhanced plasma flow occurred about 30 minutes after a switch in the direction of the interplanetary magnetic field from northward to southward. The electric fields across the polar cap immediately before and during the substorm were essentially unchanged indicating that an enhancement in the ionospheric conductivity rather than the electric field must be responsible for the large increase in the auroral electrojet current during the substorm. Author

N74-20976*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.

REMOTE SENSING IN MICHIGAN FOR LAND RESOURCE MANAGEMENT: WATERFOWL HABITAT MANAGEMENT AT POINTE MOUILLEE Technical Report, 1 Jun. 1972 - 31 Dec. 1974

A. N. Sellman, I. J. Sattinger, L. B. Istvan, W. R. Enslin, W. L. Myers, and M. C. Sullivan Apr. 1974 45 p refs Prepared in cooperation with Michigan State Univ. and Mich. Dept. of Natural Resources Original contains color illustrations

(Grants NGR-23-005-552; NGL-23-004-083)

(NASA-CR-137430; ERIM-193400-1-T) Avail: NTIS HC $5.25 CSCL 08B

For many years the Pointe Mouillee State Game Area, located on the Lake Erie shoreline just south of Detroit, has been a prime waterfowl habitat. The usefulness of the site for this purpose has been impaired because of the gradual deterioration of the marshland and severe flooding and storms during the spring of 1973. Also, it has been proposed that a dredge spoils area be located in or near the marsh. To aid the future management of a diked refuge area of 148 hectares within the State Game Area, a detailed vegetation inventory was prepared by photointerpretation and a generalized vegetation inventory was obtained by processing multispectral scanner imagery. Also, an analysis was conducted to determine the magnitude of past losses of marshland and the possibilities of replacing this lost habitat. The analysis indicated that large additions to waterfowl habitat could be provided by changes in management of vegetation in existing sections of the State Game Area, through acquisition and conversion of adjacent land by the Michigan Department of Natural Resources, and by the proposed construction of a barrier dike offshore of Pointe Mouillee. Altogether, the various measures considered in this report could affect a total area of nearly 13 sq. km. Author

N74-20977# Joint Publications Research Service, Arlington, Va.

GEOELECTRIC CHARACTERISTICS OF THE EARTH'S CRUST AND THE UPPER MANTLE

B. S. Enenshteyn 1 Apr. 1974 8 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 214, no. 1, 1974 p 87-90

(JPRS-61626) Avail: NTIS HC $4.00

A discussion is presented of the geoelectric characteristics of the earth's crust and the upper mantle. Author

N74-20978*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

A DETAILED PROCEDURE FOR THE USE OF SMALL-SCALE PHOTOGRAPHY IN LAND USE CLASSIFICATION

Paul L. Vegas (Mississippi Test Facility, Bay St. Louis) Washington Apr. 1974 45 p ref

(NASA-TN-D-7542; JSC-S-372) Avail: NTIS HC $3.25 CSCL 08B

A procedure developed to produce accurate land use maps from available high-altitude, small-scale photography in a cost-effective manner is presented. An alternative procedure, for use when the capability for updating the resultant land use map is not required, is also presented. The technical approach is discussed in detail, and personnel and equipment needs are analyzed. Accuracy percentages are listed, and costs are cited. The experiment land use classification categories are explained, and a proposed national land use classification system is recommended. Author

N74-20979*# New York Univ., N.Y. Dept. of Meteorology and Oceanography.

A CURVATURE-CORRECTED KIRCHHOFF FORMULATION FOR RADAR SEA-RETURN FROM THE NEAR VERTICAL

Frederick C. Jackson Washington NASA Apr. 1974 77 p refs

(Contract NAS1-10090)

(NASA-CR-2406; TR-72-1) Avail: NTIS HC $4.00 CSCL 17I

A new theoretical treatment of the problem of electromagnetic wave scattering from a randomly rough surface is given. A high frequency correction to the Kirchhoff approximation is derived from a field integral equation for a perfectly conducting surface. The correction, which accounts for the effect of local surface curvature, is seen to be identical with an asymptotic form found by Fock (1945) for diffraction by a paraboloid. The corrected boundary values are substituted into the far field Stratton-Chu integral, and average backscattered powers are computed assuming the scattering surface is a homogeneous Gaussian process. Preliminary calculations for K(-4) ocean wave spectrum indicate a resonable modelling of polarization effects near the vertical, theta < 45 deg. Correspondence with the results of small perturbation theory is shown. Author

N74-20980*# Control Data Corp., Minneapolis, Minn. Research Div.

PERIODIC VARIATIONS IN STRATOSPHERIC MERIDIONAL WIND FROM 20-65 km, AT 80 DEG N TO 8 DEG S

G. D. Nastrom, A. D. Belmont, and D. G. Dartt 15 Mar. 1974 82 p refs

(Contract NAS2-7807)

(NASA-CR-114744; RR-1) Avail: NTIS HC $7.25 CSCL 04A

The variability of stratospheric meridional winds is examined in both space and time. Height-latitude sections for January along 70 deg E and 90 deg W show a divergence zone above 50 km near 60 deg N and an intense convergence zone 40 km near 50 deg N over North America. This latter structure, with southward winds in the Arctic and northward winds at mid-latitudes over North America, persists from October through April. Tidal winds dominate all other circulation features in summer at all latitudes, and throughout the year at low latitudes. To help understand the observed patterns of variability, long-term periodic features are analyzed. The quasi-biennial oscillation, annual wave, and four-month wave have amplitudes of about 10, 20, and 10 m/sec respectively in the Arctic near 45 km. The phase of the annual wave changes by nearly 180 deg in a narrow zone near 45 deg N. The semiannual wave has an amplitude of 10 m/sec. 50 deg N above 50 km equinoctial phase dates in the region of maximum amplitude. This polar semiannual wave corresponds closely to that previously found in the zonal wind. Author

N74-20981*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

GEOMETRICAL GEODESY TECHNIQUES IN GODDARD EARTH MODELS

F. J. Lerch Jan. 1974 40 p refs Presented at the Intern. Assoc. Geodesy Symp. on Computational Methods in Geometrical Geodesy, Oxford, 2-8 Sep. 1973

(NASA-TM-X-70619; X-592-73-339) Avail: NTIS HC $5.00 CSCL 08E

The method for combining geometrical data with satellite dynamical and gravimetry data for the solution of geopotential and station location parameters is discussed. Geometrical tracking data (simultaneous events) from the global network of BC-4 stations are currently being processed in a solution that will greatly enhance of geodetic world system of stations. Previously the stations in Goddard earth models have been derived only from dynamical tracking data. A linear regression model is formulated from combining the data, based upon the statistical technique of weighted least squares. Reduced normal equations, independent of satellite and instrumental parameters, are derived for the solution of the geodetic parameters. Exterior standards for the evaluation of the solution and for the scale of the earth's figure are discussed. Author

N74-20982*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A GLOBAL MAGNETIC ANOMALY MAP
R. D. Regan (USGS, Silver Spring, Md.), W. M. Davis (USGS, Silver Spring, Md.), and J. C. Cain Apr. 1974 24 p refs Submitted for publication Original contains color illustrations (NASA-TM-X-70628; X-922-74-98) Avail: NTIS HC $4.25 CSCL 08E

A subset of POGO satellite magnetometer data has been formed that is suitable for analysis of crustal magnetic anomalies. Using a thirteenth order field model, fit to these data, magnetic residuals have been calculated over the world to latitude limits of plus 50 deg. These residuals averaged over one degree latitude-longitude blocks represent a detailed global magnetic anomaly map derived solely from satellite data. Preliminary analysis of the map indicates that the anomalies are real and of geological origin. Author

N74-20983# Lockheed Missiles and Space Co., Palo Alto, Calif.
CONFIGURATION OF THE GEOMAGNETIC FIELD LINES OF FORCE IN THE MAGNETOSPHERE TAIL
S. I. Isaev and M. I. Pudovkin [1973] 4 p refs Transl. into ENGLISH from the book "Poliarnye Siianiia i Protsessy v Magnetosfere Zemli", Leningrad, Nauka, 1972 p 19-23
Avail: NTIS HC $4.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The theoretical picture of solar wind interaction with the geomagnetic field and the configuration of the geomagnetic lines of force on the day side of the magnetosphere are discussed. Illustrations of the configuration of the magnetic field lines of force are provided. The current density distribution in the neutral layer is diagrammed. It is concluded that the magnetic field pressure in the magnetosphere tail is not equilibrated by the static but by the dynamic pressure of the solar plasma flux. This fact determines that the magnetopause does not remain completely parallel to the direction of the solar wind and a distortion of the magnetosphere tail results. Author

N74-20984# Institut d'Aeronomie Spatiale de Belgique, Brussels.
LINE BY LINE ABSORPTION IN THE FUNDAMENTAL BAND OF NITRIC OXIDE [ABSORPTION RAIE PAR RAIE DANS LA BANDE FONDAMENTALE INFRAROUGE DU MONOXYDE D'AZOTE]
S. Cieslik and C. Muller 1973 26 p refs In FRENCH; ENGLISH summary
(Aeronomica-Acta-A-114) Avail: NTIS HC $.50

The intensity of rotation-vibrational spectral lines in the fundamental band X2Pi (at 5.3 micron) of nitric oxide was determined for its application to aeronomical analysis of the stratosphere. The absorption cross sections were computed and computed values agreed with experimental results. ESRO

N74-20985# California Univ., Livermore. Lawrence Livermore Lab.
SIMULATION OF CHEMICAL KINETICS TRANSPORT IN THE STRATOSPHERE
J. S. Chang, A. C. Hindmarsh, and N. K. Madsen Oct. 1973 18 p refs Presented at the Symp. on Stiff Differentials System, West Germany, 4 Oct. 1973 Sponsored by AEC
(UCRL-74832; Conf-731043-1) Avail: NTIS HC $3.00

With the advent of supersonic transports, the environmental impact of the engine exhaust has become a major concern. A principal concern has been the possible catalytic destruction of ozone by nitric oxide (NO). Given a fleet of SST's the injected NO concentration could exceed many times the ambient. Furthermore, the enhanced NO concentrations will greatly increase the destruction of O3 through the so-called NO(x) catalytic cycle. It has been estimated that based on certain estimates of NO production rate from SST there could be a world wide reduction in ozone of from 3% to 50%. Atmospheric nuclear tests in the 1950's and early 1960's injected substantial amounts of NO(x) into the stratosphere. It would follow that an examination of the ozone measurements of that period could possibly be used to estimate the significance of catalytic destruction of ozone in the stratosphere. In order to carry out such a study one must use a time dependent model and compute the time history of perturbations from 1956 to 1970 starting with the ambient atmosphere as determined by the model. NSA

N74-20986# Hawker Siddeley Dynamics, Ltd., Hatfield (England).
THE INFLUENCE OF THE ATMOSPHERE ON REMOTE SENSING MEASUREMENTS. VOLUME 1: SUMMARY REPORT
J. B. Farrow, comp. Dec. 1973 94 p refs Sponsored by ESRO 4 Vol.
(HSDP-TP-7400-Vol-1; ESRO-CR(P)-353) Avail: NTIS HC $7.75

Information is provided on the basic physics of atmospheric processes which influence remote sensing measurements. These processes include:- gaseous absorption and emission; particle scattering, absorption and emission; and refraction and turbulence. Standard atmospheric conditions and variations which can occur in the mean state are described. The influence of the atmosphere on incident and reflected solar radiation and on emitted scene radiation are described with reference to the major types of sensor. Various possible means of correcting atmospherically degraded data are reviewed. Author (ESRO)

N74-20987# Hawker Siddeley Dynamics, Ltd., Hatfield (England).
THE INFLUENCE OF THE ATMOSPHERE ON REMOTE SENSING MEASUREMENTS. VOLUME 2: ULTRAVIOLET, VISIBLE AND INFRARED REGIONS
Dec. 1973 170 p refs Sponsored by ESRO 4 Vol.
(HSDP-TP-7400-Vol-2; ESRO-CR(P)-354) Avail: NTIS HC $11.50

Atmospheric influences on remote sensing are reviewed for wavelengths from the ultraviolet to the infrared region. The earth's atmosphere is described, and the important physical processes occurring within it are explained. These processes include: gaseous absorption and emission; particle scattering, absorption, and emission; and refraction and turbulence. The influences of these atmospheric processes on passive and active sensors mounted on various platforms are reviewed. Correction techniques, to restore atmospherically degraded data to an error-free form, are examined. ESRO

N74-20988# Hawker Siddeley Dynamics, Ltd., Hatfield (England).
THE INFLUENCE OF THE ATMOSPHERE ON REMOTE SENSING MEASUREMENTS. VOLUME 3: MICROWAVE AND RADIO WAVELENGTHS
Dec. 1973 132 p refs Sponsored by ESRO 4 Vol.
(HSDP-TP-7400-Vol-3; ESRO-CR(P)-355) Avail: NTIS HC $9.75

Atmospheric influences on remote sensing are reviewed for wavelengths in the microwave and radio region. The earth's atmosphere is described and the important physical processes occurring under it are explained. These processes include: gaseous absorption and emission; particle scattering, absorption, and emission; and refraction and turbulence. The influence of these atmospheric processes and passive and active sensors mounted on platforms are reviewed. Correction techniques, to restore atmospherically degraded data to error free, are examined. ESRO

N74-20989# Royal Aircraft Establishment, Farnborough (England).
UPPER-ATMOSPHERE DENSITIES DURING AN INTENSE MAGNETIC STORM, FROM THE LOGACS EXPERIMENT
R. R. Allan, G. E. Cook et al Oct. 1973 25 p refs
(RAE-TR-73150; BR37516) Avail: NTIS HC $4.25

An independent examination of density data provided by the Low-G Accelerometer Calibration System during a period of intense geomagnetic activity was made. The dayside response is clearest as the geomagnetic index starts to decline, and shows peaks on the magnetic equator near + or - 45 deg geomagnetic latitude and near the polar caps. There are pronounced troughs near + or - 60 deg geomagnetic latitude; in the northern trough the density falls to 70% of the undisturbed value. In succeeding passes the structure collapses irregularly. It is suggested that the structure shows where energy is injected in

an intense storm near the magnetic equator, near the particle precipitation zones, and over the polar caps. ESRO

N74-20990# Kiruna Geophysical Observatory (Sweden).
KIRUNA GEOPHYSICAL DATA. DATA SUMMARY 73/7-9, JULY-SEPTEMBER 1973
G. Gustafsson, ed. 1973 64 p Prepared jointly with European Space Sounding Rocket Range
Avail: NTIS HC $6.25

Geomagnetic K-indices and ionospheric absorption tables for the period July to September 1973 are presented together with diagrams for the diurnal variation of cosmic noise absorption. ESRO

N74-20991# Kiruna Geophysical Observatory (Sweden).
KIRUNA GEOPHYSICAL DATA. DATA SUMMARY 73/10-12, OCTOBER-DECEMBER 1973
G. Gustafsson, ed. 1973 70 p Prepared jointly with the European Space Sounding Rocket Range
Avail: NTIS HC $6.50

Geomagnetic K-indices, all-sky photography of auroras, and ionospheric absorption tables for the period October-December 1973 are presented together with diagrams for the diurnal variation of cosmic noise absorption. ESRO

N74-20992# Danish Meteorological Inst., Charlottenlund.
THULE GEOPHYSICAL OBSERVATORY. MAGNETIC RESULTS, 1967
E. Friis-Christensen, E. Ulander, and J. Wilhjelm 1973 57 p refs
(ISBN-87-7478-070-0) Avail: NTIS HC $6.00

Regular recording of the three magnetic elements H, D and Z took place by means of three sets of photographic variometers - two standard and one quick-run magnetograph. Details of the magnetographs are given, as well as the determination of baseline values and reduction formulas. Tables of the hourly mean values and hourly ranges of magnetic intensity are given. ESRO

N74-20993# Defense Mapping Agency Topographic Center, Washington, D.C.
REPORT ON THE TWELFTH PARALLEL SURVEY
Jul. 1973 68 p refs
(AD-773771) Avail: NTIS CSCL 08/2

Preparation of this report was prompted by the interest of the United States and cooperating countries in making available to the participating nations a history of this most important project. The Third United Nations Regional Cartographic Conference for Africa which was held at Addis Ababa, Ethiopia, in November-December 1972, supported this endeavor. At this conference the members recommended additional geodetic activities in Africa, by African countries and with cooperation of countries outside Africa. Although this report does not contain positional information, it does address a number of aspects of the 12th Parallel Survey Project and it is hoped that it will contribute to further the interest in geodetic progress in Africa. GRA

N74-20994# Naval Research Lab., Washington, D.C.
AN IONOSPHERIC MODEL FOR CURRENTS, THE ELECTRIC FIELD, AND THE PLASMA DENSITY IN AN AURORAL ARC
Joel A. Fedder Jan. 1974 28 p refs
(AD-773405; NRL-MR-2691) Avail: NTIS CSCL 04/1

A model of an auroral arc is presented for the self consistent calculations of currents, the ionospheric electric field, and the plasma density. The results of model calculations are presented for a selection of assumed values of the magnetospheric electric field and an anomalous resistance to geomagnetic field-aligned currents. These calculated currents and electric fields are shown to be in qualitative agreement with the published measurements. Author (GRA)

N74-20995# Defense Mapping Agency Aerospace Center, St. Louis, Mo. Technical Translation Branch.
EXPERIMENTAL WORK WITH THE HIGH-PRECISION VIRG-61 GRAVIMETER
V. S. Mironov and V. V. Vorobeva Dec. 1973 9 p refs Transl. into ENGLISH from Gefiz. App. (USSR), no. 48, 1972 p 132-134
(AD-773911; DMAAC-TC-1988) Avail: NTIS CSCL 08/7

The paper discusses an experimental-productive high-precision gravimetric survey in four detailed areas of the ore-bearing regions of Central Kazakhstan. The method of work was the same in all four areas. The conclusions drawn from this survey are listed in the paper. Author (GRA)

N74-20996# Ohio State Univ., Columbus. Dept. of Geodetic Science.
INVESTIGATIONS ON THE DOWNWARD CONTINUATION OF AERIAL GRAVITY DATA
Klaus- Peter Schwarz Sep. 1973 86 p refs
(Contract F19628-72-C-0120; AF Proj. 8607)
(AD-772709; DGS-204; AFCRL-TR-73-0590; SR-11) Avail: NTIS CSCL 08/5

The subject of the report is downward continuation of gravity from flying altitudes to a reference surface. This is done by a numerical inversion of the upward continuation integral, which leads to the inversion of an ill conditioned matrix. The first part considers computational and numerical problems such as the discretization of the upward continuation integral, the improvement of convergence of the iterative inversion by using the knowledge of the spectrum to obtain convergence factors, and the improvement of the conditioning of the matrix. In the second part, downward continuation of gravity is discussed theoretically as an improperly posed problem using Tykhonov's regularization, and various solutions proposed in the literature are compared. Author (GRA)

N74-20997# TRW Systems Group, Redondo Beach, Calif.
HIGH ALTITUDE PLASMA EFFECTS Final Report, 28 Feb. 1972 - 31 Dec. 1973
B. Arnush, B. D. Fried, C. F. Kennel, R. L. Stenzel, and A. Y. Wong Dec. 1973 30 p refs
(Contract F30602-72-C-0304; ARPA Order 1423)
(AD-774550; TRW-21961-6006-RU-00; RADC-TR-74-23) Avail: NTIS CSCL 04/1

The principal results of the program to simulate ionospheric modification field experiments in the QUIPS device are reviewed. The main conclusions are: By linear mode conversion electromagnetic waves (EMW) propagating in the inhomogeneous laboratory plasma produced very intense electron plasma waves (EPW) (orders of magnitude above the EMW) propagating along the density gradient. Unanticipated by conventional theory, the linearly converted EPW was the lowest threshold pump of the parametric instability. In square wave operation, at the turn-off and turn-on of the EMW pump, the ponderomotive force due to the electrostatic field of the linearly converted EPW produced a large pulse of density perturbation, proportional to incident power (i.e., without threshold), which propagated away from the plane of reflection of the EMW. GRA

N74-20998# Technischen Universitaet, Munich (West Germany).
RESEARCH ON ELF PROPAGATION Final Report, 1 Apr. 1972 - 31 Mar. 1973
Herbert L. Koenig 1 Jun. 1973 12 p refs
(Grant AF-AFOSR-2320-72; AF Proj. 5831)
(AD-774437; Rept-2320/1; AFCRL-TR-73-0594) Avail: NTIS CSCL 04/1

The present research program has been carried out to obtain more detailed information about the propagation phenomena and the origin of ELF-waves in the frequency range of the SCHUMANN resonances, i.e. between 4 Hz and 24 Hz. Simultaneous measurements of both the magnetic and the electric fields were performed by two almost identically equipped stations. One station is located near Kingston, R.I., U.S.A., and supervised by members of the University of Rhode Island; the other, operated by the author, is situated in Brannenburg/Munich, W.Germany. The results of these cooperative investigations will permit prediction of the state of the lower ionosphere and some types of Solar events. (Modified author abstract) GRA

N74-20999# California Univ., Los Angeles. Dept. of Meteorology.
MORPHOLOGY AND DYNAMICS OF IONOSPHERIC

STORMS Final Scientific Report, 1 Jan. 1971 - 31 Jan. 1973
S. V. Venkateswaran 7 Sep. 1973 357 p refs
(Contract F19628-71-C-0075)
(AD-774760; AFCRL-TR-73-0610) Avail: NTIS CSCL 04/1

The document consists of five scientific reports. In the first report, computer programs are described which simulate ionospheric currents responsible for quiet-day ground magnetic variations at middle and equatorial geomagnetic latitudes. The program enables us to deduce the large-scale electrostatic fields generated by dynamo actions in the ionosphere. The second report describes a computer program for mapping of the ground magnetic potential pattern on any given day, either quiet or disturbed. The other reports are reprints of articles which have been either fully or partially supported by this contract.
Author (GRA)

N74-21000# Missouri Univ., Rolla. Dept. of Electrical Engineering.
COMPARATIVE EVALUATION OF AN IMPROVED SINGLE FLIGHT STEREO RADAR TECHNIQUE Final Technical Report
Gordon E. Carlson and George L. Bair Feb. 1974 98 p refs
(Contract N00014-69-A-0141-0008; NR Proj. 387-069)
(AD-774762; CSR-74-1) Avail: NTIS CSCL 08/2

An improved single flight technique for obtaining stereo radar image pairs is evaluated and compared with a previously proposed single flight technique and a previously implemented two flight technique. The prime concern of the report is a performance evaluation and comparison of the techniques with the use of computer generated pseudo-radar images. The terrain modelling and computer simulation methods used are described as well as stereocomparator measurement results. Improved stereoviewability was observed for the improved single flight technique as compared with the previously proposed single flight technique and both were better than the previously implemented two flight technique. The improved stereoviewability of the single flight images resulted in terrain flight measuring errors which are only 59% as large as those for the two flight technique. (Modified author abstract) GRA

N74-21001# Scripps Institution of Oceanography, San Diego, Calif. Visibility Lab.
AIRBORNE MEASUREMENTS OF OPTICAL ATMOSPHERIC PROPERTIES IN SOUTHERN ILLINOIS
Seibert Qu. Duntley, Richard W. Johnson, and Jacqueline Gordon Jul. 1973 156 p refs
(Contract F19628-73-C-0013; AF Proj. 7621)
(AD-774597; SIO-Ref-73-24; AFCRL-TR-73-0004; SR-3) Avail: NTIS CSCL 04/1

The report presents daytime atmospheric optical data collected chiefly with airborne instruments during a field expedition to southern Illinois in the summer of 1971. Results from five flights are presented. The data include the natural irradiance upon horizontal plane surfaces, scalar irradiances, total volume scattering coefficients, atmospheric beam transmittances, path radiances, directional path reflectances, and directional terrain reflectances. Data for sunlight conditions were derived for downward-looking paths of sight inclined at six zenith angles (95, 100, 105, 120, 150, and 180 degrees) from altitudes of 3000 meters above ground level and lower in three spectral regions, as follows: two narrow band optical filters with mean wavelengths of 478 and 664 nanometers; and one broad band sensitivity representing the photopic response with a mean wavelength of 557 nanometers. Author (GRA)

N74-21002# Aerospace Corp., El Segundo, Calif. Space Physics Lab.
SELF-CONSISTENT ELECTROSTATIC FIELD MAPPING IN THE HIGH-LATITUDE IONOSPHERE Report for Apr. - Aug. 1973
Y. T. Chiu 22 Jan. 1974 46 p refs
(Contract F04701-73-C-0074)
(AD-774097; TR-0074(4260-10)-5; SAMSO-TR-74-13) Avail: NTIS CSCL 04/1

In an attempt to study the possible connections between upper and lower atmospheric electricity, the restricted boundary-value problem of self-consistent electrostatic field mapping in the collision-dominated lower ionosphere is solved. It is found that, while the exact lower boundary value is unknown, the perpendicular field maps through the ionosphere with little change. The parallel field associated with the perpendicular solutions are generally 0.001 - 0.0001 that of the perpendicular field above 150 km; however, below 150 km, the two fields are of comparable magnitude. Magnetospheric electricity may contribute to the value of the high-latitude vertical field at mesopheric heights, since E(parallel) is comparable to E(perpendicular) at the bottomside ionosphere. Author (GRA)

N74-21003# Ohio State Univ. Research Foundation, Columbus.
HIGH FREQUENCY SCATTERING IN THE LOWER D-REGION AT FT. CHURCHILL DURING THE NOVEMBER 2, 1969 POLAR CAP ABSORPTION EVENT Final Report
S. C. Shah and T. A. Seliga Jan. 1974 78 p refs
(Contract DAAD05-71-C-0421)
(AD-774301; SURF-3261-2; BRL-CR-133) Avail: NTIS CSCL 04/1

Low-lying D-region ionosonde echoes, observed during the Polar Cap Absorption Event of November 2, 1969 at Ft. Churchill, are shown to be consistent with scattering from turbulent irregularities in electron density and collision frequency. A radar-type equation relating the scattering cross-section of the ionosphere, ionospheric absorption and the ionosonde system parameters is developed. Calculations of a receiver detection parameter, using available experimental data for the PCA, and assumed threshold levels for detection are combined to construct analytical ionograms. The results indicate a general agreement with the observed ionograms and a sensitivity to irregularity scale size, strength and spatial autocorrelation. (Modified author abstract) GRA

N74-21004# Lancaster Univ., Bailrigg (England). Dept. of Environmental Sciences.
IONOSPHERIC RESPONSE TO SOLAR ECLIPSE Scientific Report, 1 May - 31 Dec. 1973
Arthur N. Hunter, David G. Felgate, and Brian K. Holman 31 Dec. 1973 8 p refs
(Grant AF-AFOSR-2544-73; AF Proj. 9767)
(AD-774461; EOARD-TR-74-3; SR-1) Avail: NTIS CSCL 04/1

Faraday rotation stations were installed at Nairobi, Dar es Salaam, Blantyre and Grahamstown and were operated for about ten days including the period of the eclipse on the 30th of June 1973. The records show that total electron content perturbations due to the eclipse were much smaller than other authors had forecast. Refinement of the raw data by filtering is in progress but the results are expected still to be difficult to interpret in terms of gravity waves. These observations agree with those of others so far published. Author (GRA)

N74-21005# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
THE THERMOSPHERE AND THE F-REGION: A RECONCILIATION OF THEORY WITH OBSERVATIONS
Peter Stubbe 19 Jul. 1973 162 p refs
(Contract N00014-67-A-0385-0017; Grant NSF GA-33446)
(AD-774149; PSU-IRL-SCI-418) Avail: NTIS CSCL 04/1

Our present knowledge of the processes determining the F-region behavior is examined by performing detailed comparisons between theoretical and measured F-region quantities. Much of the work is devoted to adjusting the thermospheric composition and temperature as well as the neutral wind velocity. It is found that the seasonal composition changes have two main components - an annual component with a minimum and a semi-annual component with a maximum in the equatorial region. The exospheric temperature exhibits a much larger seasonal variation than indicated by present atmospheric models. The agreement between the required and theoretically obtained wind velocities is not always satisfactory, particularly at lower latitudes. Some of the relevant ion reaction rates as well as the heat input rate to the electron gas are examined. Some changes are suggested. Finally, all the modifications introduced in this work are tested by comparing the theoretical results with observations during the eclipse of March 7, 1970. (Modified author abstract) GRA

N74-21006# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
SPECIFIC IONIZATION IN THE POLAR ATMOSPHERE DUE TO PRECIPITATING HEAVY PARTICLES
Joseph G. Kelley and Bach Sellers 2 Nov. 1973 46 p refs (AF Proj. 8600)
(AD-774400; AFCRL-ERP-457; AFCRL-TR-73-0672) Avail: NTIS CSCL 04/1

An expression is derived for the specific ionization of the polar atmosphere by precipitating fluxes of heavy particles. This expression may be evaluated with the aid of a digital computer. The results depend significantly upon the selection of the proper atmospheric model. The errors introduced by neglecting the variation of pitch angle with altitude and by simplifying the expression for stopping power were found to be acceptable at most altitudes of interest, permitting the use of a much simpler expression. The additional ionization contributed by particles returning through a given altitude after mirroring at lower altitudes was found to be negligible. Author (GRA)

N74-21007# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDY OF IONOSPHERIC PLASMA
J. Hieblot and M. Thue 30 Jan. 1974 19 p refs Transl. into ENGLISH from "Comite Mondial de la Recherche Spatiale", COSPAR, Paris, Report, May 1973 p 49-60
(AD-774396; FTD-HC-23-434-74) Avail: NTIS CSCL 04/1

Contents: High hybrid resonance, low hybrid resonance, self-impedance probes, Soviet mass spectrometers, EIDI program, ISIS program, study of magnetospheric plasma, French experiment on the GEOS (CERS-ESRO) satellite, ARAKS program, measurement of the electric field, the Dragon experiment, launched from Argentina, OMEGA-2 campaign, studies of particle precipitation in the auroral region by means of rocket sondes, CALIPSO and ARCADE experiments. GRA

N74-21008# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
ABBREVIATED TABLES OF THERMODYNAMIC PROPERTIES TO 85 km FOR THE US STANDARD ATMOSPHERE, 1974 Air Force Surveys in Geophysics
Arthur J. Kantor and Allen E. Cole 6 Nov. 1973 23 p refs (AF Proj. 824)
(AD-774404; AFCRL-AFSIG-278; AFCRL-TR-73-0687) Avail: NTIS CSCL 04/1

Background information and abbreviated tables of the thermodynamic properties for the U.S. Standard Atmosphere, 1974, are presented. Two tables give temperature, pressure, and density data from the surface to 85 km altitude, in 2-km increments, for geopotential and geometric km. Values are unchanged from the 1962 Standard below 50 km.
Author (GRA)

N74-21009# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
TESTS OF LONG WIRE DEPLOYMENT FROM SUPERSONIC ROCKETS Instrumentation Papers
Charles B. Kalakowsky, George C. Hirst, and Edward A. Lewis 28 Aug. 1973 36 p refs
(AD-773966; AFCRL-TR-73-0553; AFCRL-IP-201) Avail: NTIS CSCL 04/1

The report covers preliminary studies undertaken to develop a technique for using ballistic missiles to tow long conducting wires into thunderclouds. This work was in support of experiments for artificially triggering lightning discharges in clouds. Some elementary, highly idealized mechanical properties of long wires are reviewed, and two approaches to high speed wire dispensing were chosen for experimentation. The mechanical configurations used are described in detail and the results of actual rocket tests at White Sands Missile Range are given. Author (GRA)

N74-21010# Wayne State Univ., Detroit, Mich. Research Inst. for Engineering Sciences.
STUDIES OF ATMOSPHERIC PROCESSES Semiannual Technical Report, 15 Dec. 1972 - 15 Jun. 1973
Edward R. Fisher and Ralph H. Kummler 15 Jun. 1973 60 p refs
(Contract F19628-72-C-0007; ARPA Order 1856; AF Proj. 8692)
(AD-774450; SATR-4) Avail: NTIS CSCL 07/4

This semi-annual report details the current results obtained in experimentally and theoretically understanding the important radiation producing chemistry of high altitude fuel afterburning. The first section summarizes the experimental investigation of infrared chemiluminescence associated with oxygen atom attack of fuel species in the Flow Discharge Facility. The second section presents the results of experimental beam measurements of the intermolecular potentials of oxygen atom collisions with various plume species for use in theoretical calculations of vibrational excitation. The vibrational excitation calculations are summarized in section three of this report. (Modified author abstract) GRA

N74-21011# Army Electronics Command, Fort Monmouth, N.J.
ATMOSPHERIC EFFECTS FOR GROUND TARGET SIGNATURE MODELING. 2. DISCUSSION AND APPLICATION OF A GENERALIZED MOLECULAR ABSORPTION MODEL
James B. Gillespie and Carmine Petracca Jan. 1974 39 p refs
(DA Proj. 1T0-61102-B-53A)
(AD-774254; ECOM-5531) Avail: NTIS CSCL 01/1

The report is a detailed discussion of the five-parameter generalization of the Zachor molecular absorption model proposed by Gibson and Pierluissi, and applies that model to a horizontal path of water vapor data. This application covers the spectral intervals of 1200 to 2200/cm and 4900 to 5800/cm with a resolution of 50/cm. The five parameters of the model are determined for each frequency, and the transmission is calculated and plotted. The results of this application are then qualitatively compared to results obtained from the modified King's function which is used in the Air Force Cambridge Research Laboratory (AFCRL) transmittance model. The transmittance values calculated with the use of these models are compared to the original data which were used in the development of the models. (Modified author abstract) GRA

N74-21012# Ohio State Univ. Research Foundation, Columbus.
ANALYSIS AND INTERPRETATION OF CW ARCAS ROCKET PROPAGATION EXPERIMENTS PERFORMED DURING THE 2 NOVEMBER 1969 POLAR CAP ABSORPTION EVENT Final Report
B. W. Lee and T. A. Seliga Jan. 1974 66 p refs
(Contract DAAD05-71-C-0421; DNA Proj. NWET-K01AAXH)
(AD-774300; OSURF-3261-1; BRL-CR-132) Avail: NTIS CSCL 04/1

Low D region electron density profiles are deduced from the H-2, H-3, H-4, and H-6 Arcas continuous wave propagation experiments conducted at Ft. Churchill, Manitoba, Canada during the November 2, 1969 Polar Cap Absorption Event (PCA). The profiles compare favorably with others obtained during the PCA and should contribute to the total collection of data of relevant ionospheric parameters associated with the event. The results indicate a major influence of solar radiation on the ambient electron density, evident by a strong dependence of the electron density profiles on solar zenith angle. The electron density profiles are interpreted according to simple chemical models of three-body attachment processes at night, ion-ion neutralization, and possible dissociative recombination mechanisms involving water cluster and non-water cluster ions. (Modified author abstract) GRA

N74-21013# Franklin Pierce Coll., Rindge, N.H. Dept. of Research.
SOLAR CYCLE VARIATIONS OF GEOMAGNETICALLY TRAPPED RADIATION Final Report, 20 Nov. 1968 - 30 Jun. 1973
Ernest C. Holeman 31 Jul. 1973 254 p refs
(Contract F19628-69-C-0139; AF Proj. 8600)
(AD-774042; AFCRL-TR-73-0481) Avail: NTIS CSCL 04/1

A summary is given of work on new interpretation of features in the spectra of water vapor and carbon dioxide, and of the compilation of tables of lines of those and other molecules for identification of molecular lines in the infrared spectra of the earth and sunspots. Author (GRA)

N74-21246 Joint Publications Research Service, Arlington, Va.
THE REGIME OF THE PRESENT LEVEL OF THE CASPIAN SEA AND FORECASTING ITS FUTURE LEVELS
K. I. Smirnova *In its* Meteorol. and Hydrol., No. 1, 1974 (JPRS-61729) 11 Apr. 1974 p 77-86 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 1, 1974 p 56-62 (For availability see N74-21239 12-20)

N74-21247 Joint Publications Research Service, Arlington, Va.
CALCULATION OF THE WAVE REGIME OF SHELF BODIES OF WATER IN THE EXAMPLE OF THE BLACK SEA
G. V. Rzheplinskiy and L. N. Nazaretskiy *In its* Meteorol. and Hydrol., No. 1, 1974 (JPRS-61729) 11 Apr. 1974 p 87-94 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 1, 1974 p 63-68 (For availability see N74-21239 12-20)

N74-21248 Joint Publications Research Service, Arlington, Va.
MODEL OF CALCULATION OF THE PERENNIAL FLUCTUATIONS OF THE SALT RESERVE AND MINERALIZATION OF LAKE BALKHASH
V. V. Golubtsov *In its* Meteorol. and Hydrol., No. 1, 1974 (JPRS-61729) 11 Apr. 1974 p 95-106 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 1, 1974 p 69-76 (For availability see N74-21239 12-20)

N74-21250 Joint Publications Research Service, Arlington, Va.
STATISTICAL CHARACTERISTICS OF THE SPECTRA OF THE WIND VELOCITY PULSATIONS IN THE UPPER TROPOSPHERE AND LOWER STRATOSPHERE
N. Z. Pinus *In its* Meteorol. and Hydrol., No. 1, 1974 (JPRS-61729) 11 Apr. 1974 p 116-119 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 1, 1974 p 82-84 (For availability see N74-21239 12-20)

N74-21252 Joint Publications Research Service, Arlington, Va.
QUASIBIANNUAL CYCLICITY OF THE FORMATION OF STRATOSPHERIC ANTICYCLONES IN THE TROPICAL ZONE OF THE SOUTHERN PART OF THE PACIFIC OCEAN
N. I. Pavlov and V. Ya. Tkachenko *In its* Meteorol. and Hydrol., No. 1, 1974 (JPRS-61729) 11 Apr. 1974 p 125-131 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 1, 1974 p 86-89 (For availability see N74-21239 12-20)

N74-21262 Joint Publications Research Service, Arlington, Va.
DETERMINING THE WIDTH OF THE EQUATORIAL ZONE
Ye. M. Dobryshman *In its* Meteorol. and Hydrol., No. 12, 1973 (JPRS-61632) 1 Apr. 1974 p 22-28 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 12, 1973 p 19-23 (For availability see N74-21259 12-20)

N74-21263 Joint Publications Research Service, Arlington, Va.
MODEL OF THE STANDARD RADIATION ATMOSPHERE (LONG-WAVE RADIATION)
N. A. Zaytseva, G. N. Kostyanoy, and V. I. Shlyakhov *In its* Meteorol. and Hydrol., No. 12, 1973 (JPRS-61632) 1 Apr. 1974 p 29-42 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 12, 1973 p 24-34 (For availability see N74-21259 12-20)

N74-21264 Joint Publications Research Service, Arlington, Va.
CONSTRUCTING THE BOUNDARY LAYER OF THE ATMOSPHERE ABOVE THE SURFACE WITH ARBITRARY ROUGHNESS CHARACTERISTCIS
A. S. Gavrilov *In its* Meteorol. and Hydrol., No. 12, 1973 (JPRS-61632) 1 Apr. 1974 p 43-52 refs Transl. into ENGLISH from Meteorol. Gidrol. (Mowcow), no. 12, 1973 p 35-42 (For availability see N74-21259 12-20)

N74-21266 Joint Publications Research Service, Arlington, Va.
DETERMINATION OF AEROSOL AND MOISTURE TURBIDITY OF THE REAL ATMOSPHERE
M. S. Averkiyev and T. V. Yevnevich *In its* Meteorol. and Hydrol., No. 12, 1973 (JPRS-61632) 1 Apr. 1974 p 66-73 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 12, 1973 p 53-58 (For availability see N74-21259 12-20)

N74-21267 Joint Publications Research Service, Arlington, Va.
DEFINITION OF SOME UNIVERSAL RELATIONS IN THE BOUNDARY LAYER OF THE ATMOSPHERE
G. N. Solovyev *In its* Meteorol. and Hydrol., No. 12, 1973 (JPRS-61632) 1 Apr. 1974 p 74-81 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 12, 1973 p 59-64 (For availability see N74-21259 12-20)

N74-21270 Joint Publications Research Service, Arlington, Va.
HYDRAULIC DRAG DURING FILTRATION OF WATER IN THE VEGETATIVE LAYER OF THE SOIL
A. D. Altshul and Nguyen Tay *In its* Meteorol. and Hydrol., No. 12, 1973 (JPRS-61632) p 96-105 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 12, 1973 p 77-84 (For availability see N74-21259 12-20)

N74-21273 Joint Publications Research Service, Arlington, Va.
EXPERIMENT IN DETERMINING THE MOISTURE RESERVES IN THE SNOW COVER IN THE MOUNTAINS BY THE ABSORPTION OF GALACTIC COSMIC RADIATION
S. I. Avdyushin, Yu. F. Barabanshchikov, R. M. Kogan, Yu. M. Kulagin, I. M. Nazarov, Sh. D. Fridman, and I. S. Yudkevich *In its* Meteorol. and Hydrol., No. 12, 1973 (JPRS-61632) 1 Apr. 1974 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 12, 1973 p 98-102 (For availability see N74-21259 12-20)

N74-21274 Joint Publications Research Service, Arlington, Va.
MEASURING THE SEA WAVE PARAMETERS BY THE RADIOTECHNICAL METHOD FROM AN AIRCRAFT OR SPACECRAFT
A. A. Garnakeryan, K. L. Afanasyev, V. T. Lobach, and V. V. Timonov *In its* Meteorol. and Hydrol., No. 12, 1973 (JPRS-61632) 1 Apr. 1974 p 134-143 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 12, 1973 p 102-108 (For availability see N74-21259 12-20)

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N74-21014* National Aeronautics and Space Administration, Washington, D.C.
AUDITORY DISPLAY FOR THE BLIND Patent
Raymond M. Fish, inventor (to NASA) Issued 26 Mar. 1974 6 p Filed 27 Oct. 1972 Supersedes N73-12456 (11 - 03, p 0301)
(NASA-Case-HQN-10832-1; US-Patent-3,800,082; US-Patent-Appl-SN-301417; US-Patent-Class-178-7.2; US-Patent-Class-35-35A; US-Patent-Class-178-5.8R; US-Patent-Class-178-DIG.32; US-Patent-Class-340-407) Avail: US Patent Office CSCL 14B

A system for providing an auditory display of two-dimensional patterns as an aid to the blind is described. It includes a scanning device for producing first and second voltages respectively indicative of the vertical and horizontal positions of the scan and a further voltage indicative of the intensity at each point of the scan and hence of the presence or absence of the pattern at that point. The voltage related to scan intensity controls transmission of the sounds to the subject so that the subject knows that a portion of the pattern is being encountered by the scan when a tone is heard, the subject determining the position of this portion of the pattern in space by the frequency and interaural difference information contained in the tone.
Official Gazette of the U.S. Patent Office

N74-21015* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ORBITAL AND ENTRY TRACKING ACCESSORY FOR GLOBES Patent
Edgar B. Pritchard, inventor (to NASA) Issued 26 Mar. 1974 5 p Filed 29 Nov. 1971 Supersedes N72-21416 (10 - 12, p 1608)
(NASA-Case-LAR-10626-1; US-Patent-3,798,778;

US-Patent-Appl-SN-202750; US-Patent-Class-33-1SA;
US-Patent-Class-33-46R) Avail: US Patent Office CSCL 14B

An orbital and entry tracking accessory or attachment is described which can be mounted on a globe to provide a rapid means of determining range requirements for entry vehicles returning from any orbit to any desired landing site with reasonable accuracy. The device is constructed of clear plastic strip material, and comprises a support ring, a calibrated orbital track member rigidly carried by the support ring, and a calibrated lateral range member pivotally coupled to the support ring at points such that the lateral range member is always oriented normally to the orbital track member. The assembly is mountable on the globe relatively snugly, but freely movable. At least one of the members has a detachable coupling which permits placement of the device on the globe.

Official Gazette of the U.S. Patent Office

N74-21016 Purdue Univ., Lafayette, Ind.
DEVELOPMENT OF AN AUTORANGING SCANNING SPECTROMETER AND ITS APPLICATION TO STRONTIUM 1 Ph.D. Thesis
Duane Carlson Saufley 1973 176 p
Avail: Univ. Microfilms Order No. 74-5045

An autoranging scanning system was designed and constructed to digitize the output of an infrared spectrometer and record it on magnetic tape. This system automatically scales the input signal, whose amplitude may range over ratios of 2000 to 1, to give an output signal between 0.25 and 0.9 with an appropriate multiplier. Four noise reduction techniques compatible with the electronic system were implemented. Two are a part of the electronic system itself and two utilize the computer in data processing. This system was used to observe the spectrum of neutral strontium in the wavelength region from 1.0 + 3.5 microns using a scanning spectrometer with a lead sulfide detector. The source used was an enclosed arc operating in a helium atmosphere. Fifty-seven Sr lines were measured of which twenty-nine are new. Fifteen of the new lines were predicted by the levels previously determined from lines in the visible region.

Dissert. Abstr.

N74-21017* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AUTOMATIC QUADRATURE CONTROL AND MEASURING SYSTEM Patent
John F. Hamlet, inventor (to NASA) Issued 23 Apr. 1974 6 p Filed 29 Nov. 1972 Supersedes N73-13434 (11 - 04, p 0421)
(NASA-Case-MFS-21660-1; US-Patent-3,806,802;
US-Patent-Appl-SN-310616; US-Patent-Class-324-83Q) Avail: US Patent Office CSCL 14B

A quadrature component cancellation and measuring system comprising a detection system for detecting the quadrature component from a primary signal, including reference circuitry to define the phase of the quadrature component for detection is described. A Raysistor optical coupling control device connects an output from the detection system to a circuit driven by a signal based upon the primary signal. Combining circuitry connects the primary signal and the circuit controlled by the Raysistor device to subtract quadrature components. A known current through the optically sensitive element produces a signal defining the magnitude of the quadrature component.

Official Gazette of the U.S. Patent Office

N74-21018* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELECTROMAGNETIC FLOW RATE METER Patent
Bruce A. Banks, inventor (to NASA) Issued 9 Apr. 1974 4 p Filed 30 Dec. 1971 Supersedes N72-20406 (10 - 11, p 1474)
(NASA-Case-LEW-10981-1; US-Patent-3,802,262;
US-Patent-Appl-SN-214089; US-Patent-Class-73-194EM;
US-Patent-Class-310-11; US-Patent-Class-324-34FL) Avail: US Patent Office CSCL 14B

A liquid metal, whose flow rate is to be determined, is directed through a chamber made of electrically-insulating material on which there is impressed a magnetic field perpendicular to the direction of flow of the liquid metal. The magnetic field is made to increase in strength in a downstream direction of the flow of liquid metal. At least a pair of electrodes are disposed in the chamber traversely and perpendicular to the direction of flow and an ammeter is connected between the electrodes. Electrodes may be disposed in the top or the bottom of the chamber and each may be segmented. Oppositely disposed electrodes may be used with at least one dividing wall extending from each electrode to cause reversal of the direction of flow of the liquid metal. The magnetic field may be provided by electromagnets or permanent magnets such as shaded pole permanent magnets. Official Gazette of the U.S. Patent Office

N74-21019* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
METHOD AND APPARATUS FOR CHECKING FIRE DETECTORS Patent
George T. Clawson, inventor (to NASA) Issued 9 Apr. 1974 6 p Filed 26 Dec. 1972 Supersedes N73-18436 (11 - 09, p 1034)
(NASA-Case-GSC-11600-1; US-Patent-3,802,249;
US-Patent-Appl-SN-318357; US-Patent-Class-73-1F) Avail: US Patent Office CSCL 14B

A fire detector checking method and device are disclosed for nondestructively verifying the operation of installed fire detectors of the type which operate on the principle of detecting the rate of temperature rise of the ambient air to sound an alarm and/or which sound an alarm when the temperature of the ambient air reaches a preset level. The fire alarm checker uses the principle of effecting a controlled simulated alarm condition to ascertain wheather or not the detector will respond. The checker comprises a hand-held instrument employing a controlled heat source, e.g., an electric lamp having a variable input, for heating at a controlled rate an enclosed mass of air in a first compartment, which air mass is then disposed about the fire detector to be checked. A second compartment of the device houses an electronic circuit to sense and adjust the temperature level and heating rate of the heat source.

Official Gazette of the U.S. Patent Office

N74-21020 New Hampshire Univ., Durham.
A DATA UNFOLDING TECHNIQUE AS APPLIED TO ULTRA-SOFT X-RAY DETECTORS UTILIZED IN A SOUNDING ROCKET EXPERIMENT Ph.D. Thesis
John Thomas Apostolos 1973 156 p
Avail: Univ. Microfilms Order No. 74-7028

A technique of unfolding data and the detection of photons in the 10 to 400 A wavelength range using external photoelectric devices are discussed. These techniques are used in the design and construction of a 5 to 150 A ultrasoft X-ray detector system (described in detail) for a sounding rocket experiment in which X-ray flux from the sun in the upper D and lower E region of the ionosphere was measured. Dissert. Abstr.

N74-21021# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.
DEVELOPMENT OF A 2-DIMENSIONAL WAKE DRAG EVALUATION SYSTEM Final Report
B. Ljungstroem Jan. 1973 20 p refs
(FFA-AU-860) Avail: NTIS HC $4.00

An analog wake drag evaluation system has been developed for the two dimensional insert test section of a low speed wind tunnel. The objective of the development is to obtain accurate drag measurements with a quick readout capability for two dimensional takeoff type high lift sections. The system consists of a 71 tube total pressure rake connected to a scanivalve mounted on a supporting structure capable of motion in three degrees of freedom. An analog computer and control unit is used to compute the drag from the pressure measurements.

Author

N74-21022# Joint Publications Research Service, Arlington, Va.
MAGNETOMETERS
2 Apr. 1974 36 p refs Transl. into ENGLISH from Geofiz. App. (Leningrad), no. 44, 1970 29 p
(JPRS-61636) Avail: NTIS HC $5.00

Various types and designs of magnetometers are described, including rubidium, towed, quantum, and T-airborne magnetome-

ters. The component reliability and accuracy are also considered. For individual titles, see N74-21023 through N74-21028.

N74-21023 Joint Publications Research Service, Arlington, Va.
QUARTZ FREQUENCIES GRID FOR RUBIDIUM MAGNETOMETER
V. M. Ryzhkov and V. S. Solovyev *In its* Magnetometers (JPRS-61636) 2 Apr. 1974 p 1-5 refs Transl. into ENGLISH from Geofiz. App. (Leningrad), no. 44, 1970 p 24-27 (For availability see N74-21022 12-14)

In the heterodyne method of frequency measurement, the resonance frequency is mixed with a close standard frequency stabilized by quartz. A block diagram of the generator of the quartz frequencies grid is shown; this generator was developed for a rubidium magnetometer using lateral resonance signals. A signal was observed for each isotope within the magnetometer. J.A.M.

N74-21024 Joint Publications Research Service, Arlington, Va.
PRINCIPLES FOR CONSTRUCTING TOWED COMPONENT MAGNETOMETERS
I. G. Zhuriy *In its* Magnetometers (JPRS-61636) 2 Apr. 1974 p 6-14 refs Transl. into ENGLISH from Geofiz. App. (Leningrad), no. 44, 1970 p 27-33 (For availability see N74-21022 12-14)

The advantages and disadvantages of various types of magnetometers towed along in the water by a ship are discussed. These magnetometers are used to measure the earth's magnetic field. Direct and indirect stabilization of the towed magnetometers is also reviewed. J.A.M.

N74-21025 Joint Publications Research Service, Arlington, Va.
POSSIBILITY OF CONSTRUCTING A SELF-GENERATING SYSTEM FOR A QUANTUM MAGNETOMETER
L. N. Novikov *In its* Magnetometers (JPRS-61636) 2 Apr. 1974 p 15-19 refs Transl. into ENGLISH from Geofiz. App. (Leningrad), no. 44, 1970 p 33-37 (For availability see N74-21022 12-14)

Quantum magnetometers were used for measuring weak and ultraweak magnetic fields. A block diagram of the magnetometer with optical excitation of magnetic resonance is shown. Orientation of pumping rays and registry of relative magnetic fields are measured using a photodector. Signal display for modulation of absoption near resonance of Rb-85 atoms in phase with pumping ray and quadrature are also presented. J.A.M.

N74-21026 Joint Publications Research Service, Arlington, Va.
PECULIARITIES IN OPERATION OF THE ORIENTING SYSTEM FOR A T-AIRBORNE MAGNETOMETER
A. I. Tarayev and V. L. Kantorovich *In its* Magnetometers (JPRS-61636) 2 Apr. 1974 p 20-25 refs Transl. into ENGLISH from Geofiz. App. (Leningrad), no. 44, 1970 p 37-40 (For availability see N74-21022 12-14)

Provision was made for a fixed setting of the fork of the outer suspension in the universal joint of a T-airborne magnetometer. The design and planning of the OSS for a magnetometer was carried out, based on values of maximum perturbations with respect to course, banking, and pitching angles. J.A.M.

N74-21027 Joint Publications Research Service, Arlington, Va.
CONSTRUCTION OF DIFFERENTIATING DEVICES FOR AN AIRBORNE MAGNETOMETER
S. S. Vander *In its* Magnetometers (JPRS-61636) 2 Apr. 1974 p 26-29 refs Transl. into ENGLISH from Geofiz. App. (Leningrad), no. 44, 1970 p 131-133 (For availability see N74-21022 12-14)

Measurement errors of magnetic field strength were reduced by combining a magnetic sensitive unit with a Doppler navigation system; thereby ensuring constant quantizing intervals in distance. Algorithms for operating two types of differentiating devices are identical. J.A.M.

N74-21028 Joint Publications Research Service, Arlington, Va.
DETERMINING THE ACCURACY IN REGISTRY BY HIGHLY SENSITIVE AIRBORNE MAGNETOMETERS
L. N. Kotlyarevskiy *In its* Magnetometers (JPRS-61636) 2 Apr. 1974 p 30-33 refs Transl. into ENGLISH from Geofiz. App. (Leningrad), no. 44, 1970 p 173-175 (For availability see N74-21022 12-14)

The accuracy of an airborne magnetometer survey was determined from computational results of the mean square difference between the Delta T curves. These curves were registered on the same flight path on different days or with different instruments. Another method for determining magnetometer accuracy was proposed, comparing the cross sections of reflections. J.A.M.

N74-21029*# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
INSTRUMENTATION FOR THE ATMOSPHERIC EXPLORER PHOTOELECTRON SPECTROMETER
D. P. Peletier Nov. 1973 143 p refs Sponsored in part by NASA
(Contract N00017-72-C-4401)
(NASA-CR-138986; APL/JHU-CP-030) Avail: NTIS HC $10.25 CSCL 14B

The photoelectron spectrometer (PES) is part of the complements of scientific instruments aboard three NASA Atmosphere Explorer (AE) satellites. The PES measures the energy spectrum, angular distribution, and intensity of electrons in the earth's thermosphere. Measurements of energies between 2 and 500 eV are made at altitudes as low as 130 km. The design, characteristics, and performance of the instrument are described. Author

N74-21030# National Bureau of Standards, Washington, D.C. Heat Div.
OPTICAL RADIATION MEASUREMENTS: THE PRESENT STATE OF RADIOMETRY AND PHOTOMETRY Final Report
Bruce Steiner Apr. 1974 56 p refs
(NBS-TN-594-6) Avail: SOD HC $0.95 as C13.46:594-6

The electro-optics industry and the public that depends on it are part of an informal but influential system for optical radiation measurement. The growth of this industry and of public concerns related technically to it have put severe new strains on this measurement system. The system itself must therefore be analyzed. The state-of-the-art, on which the measurement system depends, is surveyed in terms of basic measurement parameters. The measurement system is analyzed in terms of its three basic components: flow of physical standards, generation of procedural standards, and funding framework. Roles of the professional society and of the Council for Optical Radiation Measurement are reviewed. Requirements of the system are identified and the methodology of the study is reviewed in detail. Author

N74-21031# National Bureau of Standards, Washington, D.C. Mechanics Div.
A LABORATORY STUDY OF SOME PERFORMANCE CHARACTERISTICS OF AN ALUMINUM OXIDE HUMIDITY SENSOR
Saburo Hasegawa, Lewis Greenspan, James W. Little, and Arnold Wexler Mar. 1974 28 p refs
(NBS-TN-824) Avail: SOD HC $0.65 as C13.46:824

A laboratory study was made of the performance of aluminum oxide humidity sensors over a range of ambient temperatures from +20 C to -60 C encompassing dew points from +18 C to frost points of -100 C. Information was obtained on such characteristics as sensitivity, hysteresis, temperature effect, pressure-altitude effect and short-term and long-term repeatability. The sensors were found to be capable of detecting frost points as low as -100 C at ambient temperatures of -40 C and -60 C. It is estimated that the total uncertainty inherent in these sensors is approximately 4 C. Author

N74-21032# Osservatorio Astronomico, Rome (Italy).
PHOTOGRAPHIC METHOD FOR THE STATISTICAL DETERMINATION OF SOME PHOTOMETRIC AND SPATIAL PROPERTIES OF A PLANE GRANULAR GRID [METODO FOTOGRAFICO PER LA DETERMINAZIONE STATISTICA DI ALCUNE RELAZIONI FOTOMETRICHEE SPAZIALI DA UN RETINO PIANO GRANULARE]
Vincenzo Croce Mar. 1973 22 p In ITALIAN
(RR-7) Avail: NTIS HC $4.25

A method for photometric measurement of transparence applied to photographic images of an object assimilable to a granular grid is described. This measurement allows the determination of geometrical and photometric parameters of the

object. It is demonstrated that it is possible to reconstruct the value of each grid element as well as the specific luminance of grid elements and of the background. ESRO

N74-21033# Institut Franco-Allemand de Recherches, St. Louis (France).
MASS SPECTROMETRY ANALYSIS OF EXPLOSIVE DETONATION PRODUCTS. PART 1: LEAD NITRIDE [MASSENSPEKTROMETRISCHE UNTERSUCHUNGEN AN SCHWADEN DETONIERENDER SPRENGSTOFFE. TEIL I. BLEIAZID]
F. Aulinger and H. Trinks 27 Oct. 1972 35 p refs In GERMAN
(Contract T-0260-22630-21012)
(ISL-30/72) Avail: NTIS HC $4.75

In order to analyze the composition of gaseous products resulting from the detonation of a lead nitride charge in the high vacuum, a mass spectrometer previously designed for the analysis of hypervelocity gas flow is described and applied to the identification of some neutral products such as N2, N3, and N6, and also to ionized molecules such as N3(+) and N6(+). In addition this apparatus records not only the ion current vs time for various gaseous products but differentiates also the expansion velocity for various components. Provisional results show that the chemical reaction 2N3 lead to 3N2, the detonation in the high vacuum is similar to a slow decomposition of the nitride where the dimerization reaction 2N3 leads to N6 leads to 3N2. ESRO

N74-21034# Institut Franco-Allemand de Recherches, St. Louis (France).
DEVELOPMENT OF AN EXPERIMENTAL METHOD FOR THE STUDY OF SENSITIVITY OF EXPLOSIVES UNDER THE SHOCK WAVE EFFECTS [MISE AU POINT D'UNE METHODE EXPERIMENTALE POUR L'ETUDE DE LA SENSIBILITE A L'ONDE DE CHOC DES EXPLOSIFS]
Y. DeLongueville 7 Mar. 1973 26 p refs In FRENCH
(Contract SNPE-18/72/D)
(ISL-9/73) Avail: NTIS HC $4.50

An experimental device which makes it possible to trace explosive sensitivity threshold curves in a diagram intensity vs shock duration is described, and an experimental set-up generating two dimensional waves and functioning according to the principle of explosive lateral projection is presented. Two instruments for the detection of the shock-detonation transition and its parameters (pressure, time) are described. ESRO

N74-21035# Bochum Observatory (West Germany).
AERIAL PHOTOGRAPH, REMOTE SENSING, SATELLITE PHOTOGRAPH [LUFTBILD, FERNERKUNDUNG, SATELLITENAUFNAHME]
Anne- Marie Martin, comp. 1973 15 p refs In GERMAN
Presented at the DGPH and DFG Working Group meetings on 'Photointerpretation' and "Fernerkundung", Hannover, 25-26 Oct. 1973
Avail: NTIS HC $4.00

Aerial photography, remote sensing, and satellite photography are discussed. Developments in aerial photography, mapping, and automatic image evaluation are indicated. Factors influencing remote sensing data evaluation are mentioned. Satellite photography is discussed, particularly in relation to Earth Resources Technology Satellites projects. Education courses and documentation systems are mentioned. ESRO

N74-21036# Giessen Univ. (West Germany). 1. Physikalisches Inst.
EXOELECTRON DOSIMETRY OF MIXED NEUTRON AND GAMMA RADIATION FIELDS [EXOELEKTRONENDOSIMETRIE GEMISCHTER NEUTRONEN- UND GAMMASTRAHLUNGSFELDER]
A. Scharmann, W. Kriegseis, U. Brunsmann, M. Euler, and U. Wiessler Bonn Bundeswehramt May 1973 28 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(BMvg-FBWT-73-31) Avail: NTIS HC $4.50; Bundeswehramt 20 DM

BeO-ceramics, sensitized by pressing Li2O powder on their surfaces and a subsequent high temperature treatment, served as radiation detectors. Neutron detection was achieved by generating recoil protons in a thin polyethylene converter, the efficiency of which increases proportionally to the neutron energy from .0003 at 1 MeV to .0044 at 15 MeV. The energy dependence of the method was roughly calculated. It varies by less than a factor of 2 in the range from 2.5 to 12 MeV. The neutron response amounts to 8 percent of the gamma response, so that discrimination against gamma radiation is possible only when the energy dose of neutrons prevails. Author (ESRO)

N74-21037# Stuttgart Univ. (West Germany). Inst. fuer Plasmaforschung.
A FIBER OPTIC FABRY-PEROT RING DISSECTOR WITH 15 MEASURING CHANNELS [EIN FASEROPTISCHER FABRY-PEROT RINGZERLEGER MIT 15 MESSKANAELEN ('TINTENFISCH')]
B. Bitzenberger, H. F. Doebele, and J. P. R. Huni 1973 24 p refs In GERMAN
(IPF-73-3) Avail: NTIS HC $4.25

A Fabry-Perot interferometer ring dissector, capable of dissecting the incident light on the image plane in concentric ring zones of the same surface and transmitting these separately to photomultipliers, is described. The dissector rings consist of optical fibers (channels). Performance tests of the equipment described, show that optical fibers are capable of transmission in the expected optical range, and crosstalk by wrong allocation and concentricity can be sufficiently restrained. ESRO

N74-21038# Ruhr Univ., Bochum (West Germany). Bereich Extraterrestrische Physik.
MICROWAVE ANALOG STUDIES ON LIGHT SCATTERING BY DUST PARTICLES [MIKROWELLEN ANALOGIEEXPERIMENTE ZUR LICHTSTREUUNG AN STAUBPARTIKELN]
Reiner Zerull Bonn Bundesmin. fuer Forsch. und Technol. Nov. 1973 97 p refs In GERMAN; ENGLISH summary Sponsored jointly by Bundesmin. fuer Technol. and Deut. Forschungsgemeinschaft
(BMFT-FBW-73-18) Avail: NTIS HC $8.00; ZLDI, Munich 20,40 DM

Equipment for microwave analog studies on the scattering properties of nonspherical particles is described. Results for monodisperse and polydisperse mixtures of rough spheres, cubes, and octahedrons are presented and compared to the scattering properties of equivalent mixtures of spheres are discussed and compared with experimental results or theoretical considerations of other authors. Consequences for astronomical scattering problems, based on the assumption of nonspherical particles, are discussed in Zodiacal light model calculations by comparision of dust models composed either of measured irregular particles or equivalent spheres. Author (ESRO)

N74-21039# Max-Planck-Institut fuer Physik und Astrophysik, Munich (West Germany). Inst. fuer Extraterrestrische Physik.
INVESTIGATIONS ON ENERGY LOSS STRAGGLING BY CHARGE FLUCTUATIONS IN CONNECTION WITH THE DEVELOPMENT AND CALIBRATION OF A DELTA E-E-TELESCOPE FOR COSMIC RADIATION [UNTERSUCHUNGEN ZUM ENERGIEVERLUSTSTRAGGLING DURCH LADUNGSFLUKTUATIONEN IM ZUSAMMENHANG MIT DER ENTWICKLUNG UND EICHUNG EINES DELTA E-E TELESKOPES FUER KOSMISCHE STRAHLUNG]
Otto Vollmer Dec. 1973 99 p refs In GERMAN
(MPI-PAE-Extraterr-90) Avail: NTIS HC $8.00

The influence of charge fluctuations on the energy loss distribution (straggling) of ions was investigated. It is shown that if the ion alternates between just charge conditions, an analytical energy loss distribution is possible. For a general case, charge fluctuations were simulated using the Monte Carlo method with effective cross sections for charge exchanges. For the development of a delta E-E-telescope for low energetic cosmic radiation energy and particle calibrations on ion, accelerators were determined experimentally and compared with calculated calibrations. IMP-H and IMP-J satellite experiments, in which the telescope was used, are described. ESRO

N74-21040# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.

BEHAVIOUR OF THE SPINNING GYRO ROTOR
C. Huber Feb. 1973 21 p refs
(TH-73-E-34; ISBN-90-6144-034-3) Avail: NTIS HC $4.25

An elementary understanding of the physical laws governing the spinning rotor is necessary to grasp the essence and function of the various gyroscopic instruments found in today's aerospace and maritime vehicle control systems. The theory of steady state and dynamic gyro behavior is discussed, and examples are given. ESRO

N74-21041# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
THEORY OF GYRO WITH ROTATING GIMBAL AND FLEXURAL PIVOTS M.S. Thesis
G. H. M. VanDijk Sep. 1972 41 p refs
(TH-73-E-42) Avail: NTIS HC $5.25

It is shown how the cross member of the Hooke's joint exerts a centrifugal torque on the gyro rotor. The Hooke's joint is one of several possible means of suspending a gyro free of torques. A mechanical way to compensate the centrifugal torque is the use of the spring torque of flexural pivots. A damping torque which interferes with the ideal functioning of the suspension is also considered. ESRO

N74-21042# European Space Research Organization, Paris (France).
COMPARISON OF CONVENTIONAL AND ELECTRONIC INDICATOR INSTRUMENTS IN A FLIGHT SIMULATOR AND IN A TEST AIRCRAFT
H.-D. Schenk et al Jan. 1974 60 p refs Transl. into ENGLISH of Vergleich von konventionellem und Elektron. Anzeigegeraet im Flug Simulator und Versuchsflugzeug, DLR-FB-73-44, DFVLR, 1973
(ESRO-TT-13; DLR-FB-73-44) Avail: NTIS HC $6.00; DFVLR Porz-Wahn: 12.50 DM

Extensive in-flight and simulator tests supplemented by tachistoscopic investigations were carried out to compare an experimental electronic attitude director indicator with conventional flight instruments and with a modern integrated flight director. The results show that the operational qualities of the CRT-display system at least equal those of the integrated instrument. Full use of the system flexibility of the electronic display unit is expected to bring further advantages under various operating conditions. Author (ESRO)

N74-21043# European Space Research Organization, Paris (France).
THE USE OF EQUIDENSITOMETRY FOR THE DIAGNOSIS OF TWO-PHASE FLOW AND LOW-DENSITY FLOW
G. Schweiger et al Feb. 1974 36 p refs Transl. into ENGLISH of "Die Anwend. der Aequidensitometrie zur Diagnose von Zweiphasenstroemungen und Stroemungen geringer Dichte," DLR-MITT-73-02, DFVLR, 1973
(ESRO-TT-14; DLR-MITT-73-02) Avail: NTIS HC $5.00; DFVLR Porz-Wahn: 28.50 DM

Equidensitometry as a photographic evaluation method in the field of flow measurement techniques is discussed. The basic principles of equidensitometry are described, followed by an explanation of the technique used for producing photographic equidenses. Its practical application is illustrated in a two-phase flow and a low-density flow. Author (ESRO)

N74-21044# European Space Research Organization, Paris (France).
COMPARATIVE SIMULATOR STUDIES WITH THE CONTACT ANALOG CHANNEL DISPLAY AND WITH CONVENTIONAL INSTRUMENTS
Wolfram Schattenmann et al Feb. 1974 47 p refs Transl. into ENGLISH of "Vergleichende Simulatorstudien mit dem Kontaktanalogen Kanaldisplay und mit konventionellen Instrumentierungen," DLR-FB-73-57, DFVLR, 1973
(ESRO-TT-15; DLR-FB-73-57) Avail: NTIS HC $5.50; DFVLR Porz-Wahn: 13.30 DM

Tests were conducted to determine if the channel display device allows similar guidance precision as that obtained with the flight director. The device is compared in simulator tests with standard instrument landing systems, accumulated instrument landing systems, and the flight director. The results show that the channel-display offers superior guidance precision compared with instrument landing systems and equivalent precision compared with an optimized flight director. An analysis of the motion and control variables shows that the control technique of the pilot depends strongly on how the information is presented. Flying with the channel-display, the pilot uses the controls in the same manner as under visual flight conditions, enabling a continuous transition from instrument flight rules to visual flight rules and oppositely. Author (ESRO)

N74-21045# European Space Research Organization, Paris (France).
CONSTRUCTION AND CALIBRATION OF A MOLECULAR BEAM MASS SPECTROMETER SYSTEM FOR INVESTIGATION OF THE ATMOSPHERE OF THERMIONIC ENERGY CONVERTERS
Dieter Mahr Feb. 1973 28 p refs Transl. into ENGLISH of "Aufbau und Eichung einer Molekularstrahl-Massenspektrometeranlage zur Untersuchung der Atmosphaere thermionischer Energiewandler", DFVLR, Inst. fuer Energiewandlung und Elek. Antriebe, Stuttgart, report DLR-MITT-7323, 1973
(ESRO-TT-19; DLR-MITT-73-23) Avail: NTIS HC $4.50; DFVLR Porz-Wahn: 12.60 DM

The system can be used for studying the relationship between converter atmosphere and converter behavior, at the same time optimizing the system itself. The analysis is made possible by leading a molecular beam from the converter to a quadrupole mass spectrometer. This is done in such a way that the converter atmosphere is not appreciably affected by the effusion of the molecules, yet obtaining a beam of sufficient intensity to permit components with very small partial pressures to be recorded. The sensitivity of the system is enhanced by the use of the lock-in technique. A calibration of the measuring system is carried out, with a view to obtaining quantitative, as well as qualitative, data about the composition of the converter atmosphere. Author (ESRO)

N74-21046# ARO, Inc., Arnold Air Force Station, Tenn.
A HIGH-ENERGY MOLECULAR BEAM FACILITY ADAPTED TO SATELLITE TEST AND DEVELOPMENT Final Report, 1 Jun. 1972 - 31 Jul. 1973
W. B. Stephenson AEDC Feb. 1974 36 p refs Sponsored by Air Force
(ARO Proj. VF230)
(AD-774593; ARO-VKF-TR-73-136; AEDC-TR-73-197) Avail: NTIS CSCL 14/2

A molecular beam type of facility was developed which can produce satellite energy gas species in a stream large enough to be useful for testing orbital sampling instruments. An argon-seeded hydrogen beam one centimeter in diameter had argon flux rates corresponding to orbit altitudes from 290 to 600 km. The argon kinetic energy was about 8 eV, and flow times were one second at 15-sec intervals. Author (GRA)

N74-21047# Conrac Corp., Duarte, Calif.
HIGH TEMPERATURE SOLID STATE PRESSURE TRANSDUCERS FOR MILITARY JET ENGINE ENVIRONMENTS Final Technical Report, Mar. 1972 - Oct. 1973
Gerald L. Vick and J. H. House Oct. 1973 36 p refs
(Contract F33615-72-C-1179; AF Proj. 1987)
(AD-774753; AFFDL-TR-73-145) Avail: NTIS CSCL 14/2

The document reports the work performed to apply advance design and fabrication techniques to the economic development of high temperature solid state pressure transducers for military jet engine environments. Improvements in a previously developed high temperature solid state pressure transducer have been made in a number of areas. Media compatibility has been extended from clean air to conductive and mildly corrosive liquids and gases. Cost effective reductions to warrant production have been achieved. Accuracy has been improved by introduction of nonlinear temperature compensation. The operating temperature range has been extended from 660F to 750F with survival proven to 930F. Author (GRA)

N74-21048# Air Force Rocket Propulsion Lab., Edwards AFB, Calif. Technology Div.
EVALUATION OF THE MINUTEMAN 3 TOXIC VAPOR

DETECTOR
Hugh E. Malone, Jack E. Hewes, and George E. Shoemaker Dec. 1973 25 p refs
(AD-774060; AFRPL-TR-73-86) Avail: NTIS CSCL 07/4

The TVD (toxic vapor detector) was developed to monitor possible leaks from nitrogen tetroxide and monomethylhydrazine (MMH) propellants in the Post Boost Propulsion System. These leaks might pose personnel and operational hazards. Laboratory evaluation tests and field tests were conducted. Preselected contaminant tests, using diethylamine, acetaldehyde, acetone and MMH and NO2 were conducted to determine their effects as contaminants in measurement of MMH using the TVD. Results of these tests are presented. (Modified author abstract) GRA

N74-21049# Hughes Aircraft Co., Culver City, Calif. Display Systems and Human Factors Dept.
DEVELOPMENT OF DESIGN CRITERIA FOR SENSOR DISPLAYS Annual Report, May - Dec. 1973
James G. Rogers and Walter L. Carel Dec. 1973 128 p refs
(Contract N00014-72-C-0451; NR Proj. 213-107)
(AD-774725; HAC-Ref-C6619) Avail: NTIS CSCL 05/8

The program objective is: To conduct applied research using analytical and experimental investigations for identifying, defining and validating advanced concepts which may be applied to future, improved Naval and Army aircraft instrumentation systems. This includes sensing elements, data processors, displays, controls and man/machine interfaces for fixed and rotary wing aircraft for all flight regimes. The following topics are treated in the report: Psychophysical studies, modulation sensitivity function; cognitive demand studies; and analysis of display mechanization performance criteria. GRA

N74-21050# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
CROSSED FIELD ELECTRON BEAM TESTER Technical Report, 16 Aug. - 7 Sep. 1973
Friz Walter Nov. 1973 25 p refs
(AF Proj. 2002)
(AD-774588; AFAL-TR-73-362) Avail: NTIS CSCL 14/2

An experimental method for the determination of the flow state of a high intensity electron beam (CFA) moving in crossed electric and magnetic fields is considered. The fluorescence of a tracer-molecular beam (N2), as caused by inelastic collisions, is used for the determination of the electron density. It is shown that, by a choice of the 3914A line of N2 as tracer signal, the requirements for high resolution, accuracy, and freedom from probing interference can be very well satisfied. High recording speeds for 10 sec for a complete scan of the entire beam cross section still yield data accuracies and resolutions of the order of 0.01 to 0.001, if performance degradation in the optical system by mechanical vibration can be held small. Author (GRA)

N74-21051# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
ON SPECKLE DIFFRACTION INTERFEROMETRY FOR MEASURING WHOLE FIELD DISPLACEMENTS AND STRAINS Final Report, Jun. 1972 - Jun. 1973
Frank D. Adams and Gene E. Maddux Dec. 1973 51 p refs
(AF Proj. 1467)
(AD-774047; AFFDL-TR-73-123) Avail: NTIS CSCL 14/2

The procedure for using laser speckle diffraction interferometry to measure small displacements and strains is described. The variation of basic experimental parameters is investigated. A typical application of the method is discussed and data is presented for the displacement distribution around an interference fit fastener. Author (GRA)

N74-21052# Wentworth Inst., Boston, Mass.
ROCKET AND SATELLITE INSTRUMENTATION Final Report, 1 Apr. 1970 - 31 Mar. 1973
Martin J. Devin 30 Apr. 1973 17 p
(Contract F19628-70-C-0229; AF Proj. 7659)
(AD-774660; AFCRL-TR-73-0397) Avail: NTIS CSCL 19/7

Personnel, facilities, services, and materials were provided for the design, development, fabrication, assembly, installation, and testing of electro-mechanical instrumentation comprising the payloads used in aerospace vehicles flown by the Aerospace Instrumentation Laboratory of the Air Force Cambridge Research Laboratories, as a part of the upper atmosphere research program being conducted by the Air Force Systems Command. Included among the components were special devices, such as brackets, plugs, sockets, insulators, couplings, etc., as well as special probe elements to aid in obtaining data pertaining to the physical and chemical properties of the upper atmosphere. Also entailed were the design, fabrication, assembly, and testing of instruments for the remote operation and monitoring of the rocket-borne apparatus from a blockhouse. Provision was also made for the preparation and reproduction of all necessary mechanical detail and assembly drawings and circuitry schematics, as well as for participation in the preflight, flight, and post-flight field operations associated with the assembly, preparation, and launching of the probing vehicles at the various launch sites. (Modified author abstract) GRA

N74-21053# Harry Diamond Labs., Washington, D.C.
ANALOG FLUERIC GAS CONCENTRATION SENSOR
Fernando Villarroel and Robert L. Woods Jun. 1973 36 p refs
(DA Proj. 1T0-61101-A-91A)
(AD-774280; HDL-TM-73-9) Avail: NTIS CSCL 13/7

The report describes a passive flueric gas concentrator sensor that can be used to determine the concentration of a gas relative to a reference gas mixture. The sensor is composed of linear (viscosity dependent) and nonlinear (density dependent) fluid resistors connected in a bridge circuit. The bridge output is a differential pressure signal proportional to the unknown concentration. In the system discussed in this report, the low output signal of the sensor is amplified by a high-gain laminar proportional amplifier. The sensor is capable of sensing from extremely low concentrations to full gas concentrations with good linearity and low noise. Author (GRA)

N74-21054# Army Natick Labs., Mass.
THE TEMPERATURE/HUMIDITY RECORDING SYSTEM: A USER'S GUIDE
Clive L. Nickerson Jun. 1973 95 p refs
(DA Proj. 1J6-62708-D-552)
(AD-774258; USA-NLABS-TR-74-21-GP) Avail: NTIS CSCL 14/3

The document is an instructive guide describing a small lightweight battery-operated tape recording system for gathering data on shipping and storage temperature and humidity conditions within containers. A specialized magnetic tape recorder is used with resistive temperature and humidity sensors to generate hourly outputs that are magnetically stored in two tracks of 1/4-inch (6.35-mm) recording tape by means of a four-channel recording head. A third track is used for recording time reference marks, and the fourth track is available for recording other information. A separate playback deck with means of monitoring the playback signal is used for retrieval of data. Peak amplitudes of playback pulses are proportional to the recorded temperature and humidity values. (Modified author abstract) GRA

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection.

N74-21055* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DIFFUSION WELDING Patent
Kenneth H. Holko, inventors (to NASA) Issued 26 Mar. 1974 4 p Filed 29 Sep. 1972 Supersedes N73-10500 (11 - 01, p 0061) Continuation-in-part of US Patent Appl. SN-289033, filed 14 Sep. 1972
(NASA-Case-LEW-11388-2; US-Patent-3,798,748; US-Patent-Appl-SN-293726; US-Patent-Class-29-487; US-Patent-Class-29-494; US-Patent-Class-29-498; US-Patent-Class-29-504; US-Patent-Appl-SN-289033) Avail: US Patent Office CSCL 13H

Dispersion-strengthened nickel alloys are sanded on one side and chemically polished. This is followed by a single-step welding process wherein the polished surfaces are forced into intimate contact at 1,400 F for one hour in a vacuum. Diffusion, recrystallization, and grain growth across the original weld interface are obtained during postheating at 2,150 F for two hours in hydrogen. Official Gazette of the U.S. Patent Office

N74-21056* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DIGITAL CONTROLLER FOR A BAUM FOLDING MACHINE Patent
Wayne H. Bryant, inventors (to NASA) Issued 26 Mar. 1974 15 p Filed 1 Sep. 1972 Supersedes N73-11442 (11 - 02, p 0178)
(NASA-Case-LAR-10688-1; US-Patent-3,800,253; US-Patent-Appl-SN-285705; US-Patent-Class-235-151; US-Patent-Class-235-92SB; US-Patent-Class-235-92PE) Avail: US Patent Office CSCL 13I

A digital controller for controlling the operation of a folding machine enables automatic folding of a desired number of sheets responsive to entry of that number into a selector. The controller includes three decade counter stages for corresponding rows of units, tens and hundreds push buttons. Each stage including a decimal-to-BCD encoder, a buffer register, and a digital or binary counter. The BCD representation of the selected count for each digit is loaded into the respective decade down counters. Pulses generated by a sensor and associated circuitry are used to decrease the count in the decade counters. When the content of the decade counter reaches either 0 or 1, a solenoid control valve is actuated which interrupts operation of the machine. A repeat switch, when actuated, prevents clearing of the buffer registers so that multiple groups of the same number of sheets can be folded without reentering the number into the selector.
Official Gazette of the U.S. Patent Office

N74-21057* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TOTALLY CONFINED EXPLOSIVE WELDING Patent
Laurence J. Bement, inventor (to NASA) Issued 19 Mar. 1974 5 p Filed 14 Sep. 1972 Supersedes N72-33478 (10 - 24, p 3225)
(NASA-Case-LAR-10941-1; US-Patent-3,797,098; US-Patent-Appl-SN-289048; US-Patent-Class-29-470.1) Avail: US Patent Office CSCL 13H

A method and associated apparatus for confining the undesirable by-products and limiting noise of explosive welding are discussed. The apparatus consists fo a simple enclosure into which the explosive is placed and within which the explosion occurs. The shape of the enclosure, the placement of the explosive, and the manner in which the enclosure is placed upon the material to be welded determine the force of the explosion transmitted to the proposed bond area. The explosion is totally confined within the enclosure thus reducing the noise level and preventing debris from being strewn about to contaminate the weld area or create personnel hazards.
Official Gazette of the U.S. Patent Office

N74-21058* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THIOPHENYL ETHER DISILOXANES AND TRISILOXANES USEFUL AS LUBRICANT FLUIDS Patent
Norman Bilow (Hughes Aircraft Co., Los Angeles) and Richard I. Akawie, inventors (to NASA) (Hughes Aircraft Co., Los Angeles) Issued 2 Apr. 1974 3 p Filed 24 Jul. 1973 Supersedes N73-28532 (11 - 19, p 2304) Sponsored by NASA
(NASA-Case-MFS-22411-1; US-Patent-3,801,617; US-Patent-Appl-SN-382262; US-Patent-Class-260-448.2N) Avail: US Patent Office CSCL 11H

The characteristics of organosilicon compounds for lubrication under extreme conditions are discussed. The substances considered are thiophenyl ether disiloxanes and trisiloxanes. These substances have low pour points and a high degree of radiation resistance. Substitution of sulfur for the phenoxy group oxygen of either siloxane compounds has been found to result in a marked improvement in lubricity. The chemical formulas of the organic compounds are presented.
Official Gazette of the U.S. Patent Office

N74-21059* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
METHOD OF FABRICATING AN OBJECT WITH A THIN WALL HAVING A PRECISELY SHAPED SLIT Patent
P. A. Christopher (McDonnell-Douglas Corp., St. Charles, Mo.), W. J. Gross (McDonnell-Douglas Corp., St. Charles, Mo.), W. H. Henley (McDonnell-Douglas Corp., St. Charles, Mo.), and B. D. Swirsky, inventors (to NASA) (McDonnell-Douglas Corp., St. Charles, Mo.) Issued 26 Mar. 1974 5 p Filed 13 Mar. 1973 Supersedes N73-20526 (11 - 11, p 1297) Sponsored by NASA
(NASA-Case-LAR-10409-1; US-Patent-3,798,741; US-Patent-Appl-SN-340864; US-Patent-Class-29-423) Avail: US Patent Office CSCL 13H

A method is described for making a structure with a cavity and a thin wall with a precisely shaped slit. An object with a cavity having two openings, one of which is to be closed by a thin wall with a slit, is placed on the surface of a fixture. The fixture surface has a slot conforming to the size and shape of the slit to be formed in the thin wall.
Official Gazette of the U.S. Patent Office

N74-21060* National Aeronautics and Space Administration. Pasadena Office, Calif.
OPTICALLY ACTUATED TWO POSITION MECHANICAL MOVER Patent
Lien C. Yang (JPL) and Arthur J. Murphy, inventors (to NASA) (JPL) Issued 26 Mar. 1974 5 p Filed 24 Aug. 1972 Supersedes N73-29458 (11-20, p 2422) Sponsored by NASA
(NASA-Case-NPO-13105-1; US-Patent-3,798,896; US-Patent-Appl-SN-283502; US-Patent-Class-60-25) Avail: US Patent Office CSCL 13I

An optically actuated mechanical mover adapted to be moved from an ambient position to an active position, is disclosed. The mechanical mover essentially comprises a piston/cylinder arrangement including a piston that is contained within an internal cylindrical chamber of a housing. The cylindrical chamber is configured to permit the piston to be moved for the length of the chamber as a work stroke. A lock pin extending through the piston, and diametrically opposed walls of the chamber housing, retain the piston in the ambient position at one end of the chamber. An actuator for producing a pressure or shock wave that drives the piston is positioned at the end of the chamber corresponding to the piston ambient position.
Official Gazette of the U.S. Patent Office

N74-21061* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
JOURNAL BEARINGS Patent
Frederick T. Schuller and Warren A. Moore, inventors (to NASA) Issued 16 Apr. 1974 9 p Filed 27 Mar. 1972 Supersedes N72-21473 (10 - 12, p 1617)
(NASA-Case-LEW-11076-1; US-Patent-3,804,472; US-Patent-Appl-SN-238264; US-Patent-Class-308-73) Avail: US Patent Office CSCL 13I

A plurality of bearing sectors are mounted in a housing. Each sector functions as a lobed area in the bearing to obtain the required lubricant film geometry.
Official Gazette of the U.S. Patent Office

N74-21062* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DEPLOYABLE PRESSURIZED CELL STRUCTURE FOR A MICROMETEOROID DETECTOR Patent
William H. Kinard, inventor (to NASA) Issued 23 Apr. 1974 8 p Filed 28 Jan. 1972 Supersedes N72-21472 (10 - 12, p 1616)
(NASA-Case-LAR-10295-1; US-Patent-3,805,622; US-Patent-Appl-SN-221685; US-Patent-Class-73-432; US-Patent-Class-73-12) Avail: US Patent Office CSCL 13H

This disclosure comprises a plurality of individual pressurized cells which are caused to leak in response to a micrometeoroid penetration, the leak being sensed by appropriate instrumentation. The plurality of cells may be rolled into a compact arrangement such that the volume of the micrometeoroid detector is small and therefore readily packed in a payload of a launch vehicle. Once the payload is placed in orbit, the rolled up cells can be released, pressurized and provide a relatively rigid, large surface

area for detecting micrometeoroid penetration.
Official Gazette of the U.S. Patent Office

N74-21063* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GLASS-TO-METAL SEALS COMPRISING RELATIVELY HIGH EXPANSION METALS Patent
Chikara Hirayama, inventor (to NASA) (Westinghouse Elec. Corp., Pittsburgh) Issued 16 Apr. 1974 4 p Filed 21 Apr. 1970 Sponsored by NASA
(NASA-Case-LEW-10698-1; US-Patent-3,804,703; US-Patent-Appl-SN-30498; US-Patent-Class-161-196; US-Patent-Class-106-52; US-Patent-Class-117-129; US-Patent-Class-65-DIG.11) Avail: US Patent Office CSCL 11A

A glass suitable for glass-to-metal seals that has a resistance to attack by moisture and a high coefficient of linear thermal expansion is introduced. Linear expansion covers the range from 12 to 14 x 10 to the minus 6 C between room temperature and 500 C. The glass is essentially composed of, by molar percent, about 9% of K2O, about 10% of Na2O, about 70% of SiO2, about 6% Al2O3, and about 5% of MgO.
Official Gazette of the U.S. Patent Office

N74-21064* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HOLLOW ROLLING ELEMENT BEARINGS Patent
Richard J. Parker, inventor (to NASA) Issued 9 Apr. 1973 4 p Filed 30 Mar. 1973 Supersedes N73-20534 (11 - 11, p 1298) Continuation-in-part of US Patent Appl. SN-201904, filed 24 Nov. 1971
(NASA-Case-LEW-11087-3; US-Patent-3,802,753; US-Patent-Appl-SN-346361; US-Patent-Class-308-188; US-Patent-Class-308-191; US-Patent-Appl-SN-201904) Avail: US Patent Office CSCL 13I

A low mass rolling element with a lightweight core and hollow center was developed for use in bearings. The core is plated so as to provide a hard surface and increase the life and reliability of the high speed ball bearings.
Official Gazette of the U.S. Patent Office

N74-21065* National Aeronautics and Space Administration. Pasadena Office, Calif.
FLOW CONTROL VALVE Patent
Lance G. Hays, inventor (to NASA) Issued 9 Apr. 1974 6 p Filed 7 Sep. 1972 Supersedes N73-10501 (11 - 01, p 0061)
(NASA-Case-NPO-11951-1; US-Patent-3,802,660; US-Patent-Appl-SN-287150; US-Patent-Class-251-120; US-Patent-Class-137-628; US-Patent-Class-251-122; US-Patent-Class-251-210) Avail: US Patent Office CSCL 13K

A flow control valve for high temperature fluids is disclosed. The valve is characterized by an all-metal flow control unit including a tubular conduit, terminating in a valve seat, a throttling cone having an internal, truncated conical surface coaxially related to the valve seat and supported for axial motion relative to the seat, and an axially reciprocable, flow-control plug supported in coaxial relation with the cone. The plug is provided with a truncated conical surface configured to be mated with the surface of the throttling cone for regulating a flow of fluid established through the unit and a curved shut-off surface.
Official Gazette of the U.S. Patent Office

N74-21066 Maryland Univ., College Park.
THE ROLE OF POLYMER ADSORPTION AT SOLID BOUNDARIES IN HYDRODYNAMIC FRICTION REDUCTION Ph.D. Thesis
Paul A. Martino 1973 141 p
Avail: Univ. Microfilms Order No. 74-6739

The object of this study was to determine the dominant mechanism of friction reduction by investigating the nature of the solid-liquid interface under shear flow. An experimental investigation was conducted to measure hydrodynamic friction reduction and polymer adsorption on a solid boundary. Polymer adsorption was measured by ellipsometry under shear flow. It was found that the thickness of the adsorbed polymer layer decreases slightly under shear flow. It appears that friction reduction is enhanced by a polymer film with a compact structure. The results indicate that viscoelasticity in the wall region plays an important role in the mechanism of fraction reduction.
Dissert. Abstr.

N74-21067*# Rocketdyne, Canoga Park, Calif.
LIQUID HYDROGEN TURBOPUMP RAPID START PROGRAM Final Report, 30 Jun. 1971 - 27 Apr. 1973
G. S. Wong Oct. 1973 325 p refs
(Contract NAS8-27608)
(NASA-CR-120209; R-9273) Avail: NTIS HC $19.25 CSCL 13K

This program was to analyze, test, and evaluate methods of achieving rapid-start of a liquid hydrogen feed system (inlet duct and turbopump) using a minimum of thermal preconditioning time and propellant. The program was divided into four tasks. Task 1 includes analytical studies of the testing conducted in the other three tasks. Task 2 describes the results from laboratory testing of coating samples and the successful adherence of a KX-635 coating to the internal surfaces of the feed system tested in Task 4. Task 3 presents results of testing an uncoated feed system. Tank pressure was varied to determine the effect of flowrate on preconditioning. The discharge volume and the discharge pressure which initiates opening of the discharge valve were varied to determine the effect on deadhead (no through-flow) start transients. Task 4 describes results of testing a similar, internally coated feed system and illustrates the savings in preconditioning time and propellant resulting from the coatings.
Author

N74-21068*# Lockheed Missiles and Space Co., Huntsville, Ala.
RESEARCH STUDY ON MATERIALS PROCESSING IN SPACE EXPERIMENT M512 Final Report
M. R. Brashears and S. J. Robertson 1 Dec. 1973 140 p refs
(Contract NAS8-28729)
(NASA-CR-120185; LMSC-HREC-TR-D306954) Avail: NTIS HC $10.00 CSCL 13H

A study program was conducted to clarify the role of gravity in the fluid mechanics of certain molten metal processes of potential significance to manufacturing in space. In particular, analyses were conducted of the M551 Metals Melting Experiment and the M553 Sphere Forming Experiment to be conducted in the M512 Facility onboard Skylab. The M551 experiment consisted of a study of electron beam welding of various metals, and the M553 experiment studied the formation of molten metal spheres by free-floating in a near zero-gravity environment. The analyses of these experiments and a comparison with ground-based and KC135 experimental results are presented. Author

N74-21069*# Martin Marietta Corp., Denver, Colo.
THE FABRICATION AND TEST OF A DUAL SPIN GAS BEARING REACTION WHEEL Final Summary Report
R. L. Opper and W. J. Owen Nov. 1973 54 p
(Contract NAS8-29013)
(NASA-CR-120130; MCR-73-322) Avail: NTIS HC $5.75 CSCL 13I

The design and fabrication of a dual spin gas bearing reaction wheel are discussed. Numerical analyses, data, and conclusions from performance tests are reported. The unique feature of the reaction wheel is the dual gas bearing concept in which two sets of self-acting hydrodynamic bearing are used to obtain stictionless operation and low noise around zero speed and to accomodate the momentum range from plus 6.8 N-m-s to minus 6.8 N-m-s with the potential for long life inherent in gas bearings.
Author

N74-21070*# Rocketdyne, Canoga Park, Calif.
TURBOPUMPS FOR CRYOGENIC UPPER STAGE ENGINES Final Report, Jul. 1971 - Sep. 1973
A. T. Zachary, A. Csomor, and L. L. Tignac Dec. 1973 380 p
(Contract NAS8-27794)
(NASA-CR-120193) Avail: NTIS HC $22.00 CSCL 13K

Small, high-performance LO2 and LH2 turbopump assembly configurations were selected, detail designs were prepared and two of each unit were fabricated with each unit consisting of pump, turbine gas generator, and appropriate controls. Following fabrication, development testing was conducted on each type to

demonstrate performance, durability, transient characteristics, and heat transfer under simulated altitude conditions. Following successful completion of development effort, the two LO2 turbopump units and one LH2 turbopump unit were acceptance tested as specified. Inspection of the units following development testing revealed no deleterious effects of testing. The test results of LO2 turbopump assembly testing correlated well with predicted performance while the LH2 turbopump test results, though generally consistent with predicted values, did show lower than anticipated developed head at the design point and in the high flow range of operation. Author

N74-21071# National Standards Lab., Chippendale (Australia).
NOTES ON THREAD MEASURING CYLINDERS AND BALLS
R. H. Furniss and J. W. Bell 1972 31 p refs
(NSL-Tech-Paper-27) Avail: NTIS HC $4.75

A simple method of calculating the diameter of the maximum safe and practical measuring cylinder or ball which may be used for the measurement of the pitch (effective) diameter of a screw thread is given along with appropriate parts of the relevant mathematics. Tables of cylinder and ball sizes and factors are given. In addition, a comparatively short method of obtaining an acceptably accurate value of the rake correction of a multistart thread is included. The results obtained are compared with those obtained from an extant approximate method and from the precise method. Author

N74-21072*# Boeing Commercial Airplane Co., Seattle, Wash.
TESTING OF IMPROVED POLYIMIDE ACTUATOR ROD SEALS AT HIGH TEMPERATURE AND UNDER VACUUM CONDITIONS FOR USE IN ADVANCED AIRCRAFT HYDRAULIC SYSTEMS
B. K. Sellereite, A. W. Waterman, and W. G. Nelson May 1974 50 p refs
(Contract NAS3-16744)
(NASA-CR-134601; D6-41119) Avail: NTIS HC $5.50 CSCL 11A

Polyimide second-stage rod seals were evaluated to determine their suitability for applications in space station environments. The 6.35-cm (2.5-in.)K-section seal was verified for thermal cycling operation between room temperature and 478 K (400 F) and for operation in a 133 micron PA(0.000001 mm Hg) vacuum environment. The test seal completed the scheduled 96 thermal cycles and 1438 hr in vacuum with external rod seal leakage well within the maximum allowable of two drops per 25 actuation cycles. At program completion, the seals showed no signs of structural degradation. Posttest inspection showed the seals retained a snug fit against the shaft and housing walls, indicating additional wear life capability. Evaluation of a molecular flow section during vacuum testing, to inhibit fluid loss through vaporization, showed it to be beneficial with MIL-H-5606, a petroleum-base fluid, in comparison with MIL-H-83282, a synthetic hydrocarbon-base fluid. Author

N74-21073# Joint Publications Research Service, Arlington, Va.
EXPLOSIVES APPLIED IN WELDING AND POLYMERIZATION
A. Dremin and V. Kudinov 2 Apr. 1974 12 p Transl. into ENGLISH from Nauka Zhizn (Moscow), no. 11, 1973 p 50-55
(JPRS-61639) Avail: NTIS HC $4.00 CSCL 13H

A description is given of two processes where explosives are applied in welding and polymerization. Author

N74-21074# Bureau of Mines, Pittsburgh, Pa. Mining and Safety Research Center.
POTENTIAL USES FOR 400-Hz ELECTRICAL POWER SYSTEMS IN MINING
G. J. Conroy 1974 13 p refs
(BM-RI-7857) Avail: NTIS HC $4.00 CSCL 13I

A study was initiated to determine whether or not a large-scale investigation of 400-Hz applications in coal mines was justified as a means of increasing safety in operations due to size and weight reductions in portable and other mining machinery. Potential uses for 400-Hz power in mining operations are explored, and cost and size comparisons with 60-Hz systems are made. The use of variable-frequency motor drive is suggested for conveyors. The conclusion was reached that there is no significant potential safety increase due to a general size and weight reduction, as the fact of such general reduction cannot be demonstrated. Author

N74-21075# National Center of Tribology, Risley (England). European Space Tribology Lab.
TORQUE AND WEAR OF LEAD FILMED BALL BEARINGS IN AIR
M. J. Todd and A. A. McFarlane Dec. 1973 33 p refs Sponsored by ESRO
(ESRO-ESTI-2; ESRO-CR(P)-358) Avail: NTIS HC $4.75

As part of an experimental program to investigate the behavior of lead films as a lubricant technique for satellite mechanisms, angular contact bearings, coated by vacuum evaporation of lead, were examined in air, at a number of rotational speeds, for their wear and torque characteristics. The recorded torque level fluctuations at 20 revolutions per minute and above shows either progressive or sudden deterioration. It is concluded that continuous oxidation allows the buildup of lead deposits on the ball. At a speed of 1 rpm the buildup is slow and no degradation in torque noise during more than 1000 hours run was found. ESRO

N74-21076# Defence Research Information Centre, Orpington (England).
ROUNDNESS IN EXTERNALLY GROUND ROUND WORK
G. Loter Dec. 1973 8 p Transl. into ENGLISH from Officina (Milan), v. 6, 1973 p 35-37
(DRIC-Trans-3400; BR30692) Avail: NTIS HC $4.00

The grinding of overhanging work is discussed. The factors influencing the roundness of ground work depend on the work-holding part of the machine. These factors are described: the type of head bearings (shaft and bush, ball bearings, and air bearing); the method of drive (transmission motion from motor to head bearing); and the distance from the point of grinding to the first support. ESRO

N74-21077# Institut fuer Festkoerpermechanik, Freiburg (West Germany).
GEOMETRICAL EFFECTS IN ADHESIVE JOINTS
Russell A. Westmann (Calif. Univ., Los Angeles) May 1973 47 p refs
(Grant NSF GK-30773)
(WB-3/73) Avail: NTIS HC $5.50

The effects of the geometry of the adherends, near the end of the bond line, upon the strength of a shear lap adhesive joint was determined. The two dimensional elasto-static boundary value problem of a wedge bonded to a half plane along a finite length was considered. The connection transmits a normal and shear force as well as a moment. A dual integral equation formulation was used and the mathematical problem was reduced to the numerical solution of simultaneous Fredholm integral equations of the second kind. Numerical results are presented for all of the stress intensity factors and the character of the stress field is also discussed. It is shown that if the moment, shear and normal resultants transmitted across the bond line satisfy certain relations, then the singular stress field at the ends of the bond line can be eliminated. Author (ESRO)

N74-21078# European Space Research Organization, Paris (France).
TECHNIQUES OF ELECTROFORMING AND THEIR APPLICATION IN CONSTRUCTING MODELS FOR HYPERSONIC EXPERIMENTS
D. Tammenzweig, G. Rohde et al Jan. 1974 50 p refs Transl. into ENGLISH of "Verfahrenstech. der Galvanoplastik und ihre Anwend. im Modellbau fuer Hyperschallvers.," DLR-FB-73-40, DFVLR, 1973
(ESRO-TT-9; DLR-FB-73-40) Avail: NTIS HC $5.50; Original report in GERMAN: DFVLR, Porz, West Ger. 13,50 DM

The fabrication process of hypersonic wind tunnel models is described. The use of electroforming as a process that supplements traditional methods and meets the demands of shaping internal and external walls is emphasized. ESRO

N74-21079# European Space Research Organization, Paris (France).
A STUDY OF THE ANTI-WEAR EFFECTIVENESS OF

CARBOXYLIC ACIDS IN SYNTHETIC LUBRICANTS ON ESTER BASIS

Guenter Spengler, K. A. Davis, R. Woerle et al Jan. 1974 30 p refs Transl. into ENGLISH of "Untersuch. zur Abriebvermindernden Wirkung von Carbonsaeuren in Synthetischen Schmieroelen auf Esterbasis," DLR-FB-73-43, DFVLR, 1973

(ESRO-TT-10; DLR-FB-73-43) Avail: NTIS HC $4.50; Original report in GERMAN: DFVLR, Porz, West Ger. 10 DM

Antiwear effectiveness investigations of carboxylic acids with defined chemical structure in synthetic lubricants on ester basis were made using the friction and wear apparatus developed by Wintershall/Baist. The dependence of antiwear effectiveness on the structure characteristics of carboxylic acids, such as length of chain and degree of saturation, is discussed. By combining carboxylic acids with phosphorus containing EP-additives, effectiveness gaps, as they occur with tricresyl phosphate over certain load ranges, are covered. Author (ESRO)

N74-21080# European Space Research Organization, Paris (France).

SPECTROSCOPIC ANALYSIS OF WEAR METALS BASED ON THE EXAMINATION OF OIL FROM AIRCRAFT ENGINES

Eilhard Jantzen Feb. 1974 53 p refs Transl. into ENGLISH of "Ueber die spektroskopische Analyse von Metallabries anhand von Oeluntersuchungen aus Flugtriebwerken", DFVLR, Inst. fuer Flugtreib- und Schmierstoffe, Munich, report DLR-FB-73-06, 1973

(ESRO-TT-23; DLR-FB-73-06) Avail: NTIS HC $5.75

Tests were made using these spectroscopic methods on oil from JT3D engines. In addition, all oil samples were tested for light transmittance in the visible region of the spectrum. This can be used to detect oil changes and topping up. The size and shape of wear metals in JT3D aircraft engines were established by a scanning electron microscope. Author (ESRO)

N74-21081# Army Construction Engineering Research Lab., Champaign, Ill.

THE EFFECT OF WELD DEFECTS ON RFI SHIELDING EFFECTIVENESS Final Report

Kenneth W. Carlson Jan. 1974 18 p refs

(AD-773716; CERL-TR-M-43) Avail: NTIS CSCL 14/2

Many specifications for electromagnetically shielded facilities require that weld seams be 100 percent defect-free though very little data is available to support this requirement. Such high levels of quality control are expensive and time consuming. The investigation determines the effect of weld defects on the shielding effectiveness of shielded enclosures containing welded seams. More specifically, the amount of shielding degradation as a function of type and size of weld defects in electromagnetic pulse shielded enclosures was desired for RFI frequencies of 10 KHz to 10 GHz. Defects were intentionally implanted in welded 11-gage steel panels. The panels were then tested in a high-quality RFI-sealed shielded enclosure to ascertain the RFI attenuation characteristics of the defect. (Modified author abstract) GRA

N74-21082# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE PERFECTION OF FORGE AND PRESS PRODUCTION

P. V. Kamnev and K. N. Bogoyavlenskii 14 Jan. 1974 61 p Transl. into ENGLISH of the publ. "Sovershenstvovanie Kuznechno- Shtampovochnogo Proizvodstva" USSR

(AD-773869; FTD-MT-24-249-74) Avail. NTIS CSCL 13/8

The book presents information about the state of the forging and stamping production and the basic directions of its perfection. The prospects for the development of forging and stamping equipment, the most important questions of the perfection of forging and die pressing are examined with the presentation of progressive methods of the heating and obtaining of forged and stamped forgings. The prospects for the further development of sheet and volume cold stamping are shown. The progressive methods of cold plastic deformation of parts and billets are examined. GRA

N74-21083# Defense Documentation Center, Alexandria, Va.

PROTECTIVE TREATMENTS (INDUSTRIAL PROCESS) Report Bibliography, Jan. 1961 - Aug. 1973

Feb. 1974 174 p refs

(AD-773550) Avail: NTIS CSCL 11/3

This unclassified and unlimited bibliography on Protective Treatments (Industrial Process) is grouped under three major headings: Anodic coatings, antifouling coatings, and diffusion coatings. Corporate Author-Monitoring Agency, Subject, Title, and Personal Author Indexes are included. Author (GRA)

N74-21084# Aeroprojects, Inc., West Chester, Pa.

ENGINEERING FEASIBILITY STUDY OF ULTRASONIC APPLICATIONS FOR AIRCRAFT MANUFACTURE Final Report

Florence R. Meyer Sep. 1973 316 p refs

(Contract DAAJ01-72-C-0737; DA Proj. 1728037)

(AD-774305; RR-73-15) Avail: NTIS CSCL 13/8

Areas in which ultrasonic energy can be effectively applied in production metalworking processes, particularly in the manufacture of Army helicopters and light aircraft, were explored. Literature covering ultrasonic applications in various metal forming, metal removal, and metal joining processes was thoroughly reviewed to establish, in each case, the present status and the potential interms of cost effectiveness and product improvement. An annotated bibliography is included in an appendix. Several leading Army aircraft manufacturers were surveyed to examine specific metalworking problems that might be solved by ultrasonic application, and analyses were made to indicate potential benefits and cost savings in these areas. (Modified author abstract) GRA

N74-21085# Naval Civil Engineering Lab., Port Hueneme, Calif.

DEVELOPMENT OF A HYDRAZINE GAS-GENERATION SYSTEM FOR THE LARGE OBJECT SALVAGE SYSTEM (LOSS) Technical Report, Jul. 1970 - Jan. 1973

K. W. Tate Dec. 1973 65 p refs

(AD-774467; NCEL-TR-800) Avail: NTIS CSCL 13/10

The report describes the development and testing of a self-contained hydrazine-fueled, underwater gas-generation system designed to provide large volumes of noncondensable gas for a salvage buoyancy application. This system is capable of generating sufficient gas to displace 200 L tons of seawater at a depth of 850 feet. The catalytic decomposition of monopropellant hydrazine is used to produce hydrogen and nitrogen gases which serve as the buoyancy media. The hydrazine gas generation system was mated with the LOSS(Large Object Salvage System) pontoon and successfully tested in a shallow water demonstration of the integral lift system In this demonstration, a 74 L ton object was salvaged from a depth of 90 feet. The success of this in situ test demonstrated the suitability and practicality of using monopropellant hydrazine to produce large volumes of buoyancy gas. (Modified author abstract) GRA

N74-21086# New York Univ., N.Y.

STATISTICAL TREATMENT OF CERTAIN LIFE TESTING AND RELIABILITY PROBLEMS Final Report

Satya D. Dubey Dec. 1973 75 p refs

(Contract F33615-71-C-1174; AF Proj. 7071)

(AD-774537; ARL-73-0155) Avail: NTIS CSCL 14/4

In section 1 a number of problems relating to the ratio based on the expected length of time needed to observe the first r failures out of n items placed on the test ($1 < or = r < or = n$) and the expected length of time needed to observe all r failures of the sample placed on the test for various distributions (exponential, Weibull, uniform, Gamma, logistic, Pareto, Cauchy) are considered. In section 2 several interesting and useful properties of the Compound Weibull and related distributions are investigated. In section 3 power functions are derived for the Kumar-Patel test which are based on right censored samples for testing the equality of location parameters of two exponential distributions when their common scale parameter is unknown. In section 4 conditions under which a sequence of inequalities are valid are established, and some allied problems are discussed. (Modified author abstract) GRA

N74-21087# McDonnell-Douglas Astronautics Co., Titusville, Fla.

FLUIDIC RELIABILITY PROGRAM Final Report

21 Dec. 1973 170 p refs

(Contract DAAG39-72-C-0001)

(AD-774365; L0242) Avail: NTIS CSCL 13/7

Many claims have been made, some extravagantly, regarding fluidic system reliability. For the most part these claims have been substantiated qualitatively in many applications. However, in the past, quantitative methods have not been available to either predict reliability or to design accelerated failure experiments. The report describes work performed over a two year period with the purpose of developing an accelerated testing method and a method of predicting system life. (Modified author abstract) GRA

N74-21088# Nexon, Inc., Dayton, Ohio.
ASSESSMENT OF ULTRASONIC NDT INTERROGATION Final Report, 1 Mar. - 15 Jul. 1973
Stuart I. Fickler Dec. 1973 52 p refs
(Contract F33615-73-C-5105; AF Proj. 7351)
(AD-774046; AFML-TR-73-189) Avail: NTIS CSCL 14/2

The purpose is to evaluate the feasibility of detecting and characterizing small flaws (i.e. of the order of 1-100 microns) in materials by means of ultrasonic interrogation techniques. The scope of the effort encompasses an examination of the physical characteristics to be measured and their relation to the actual observable data obtained by measurement; an examination of the relation of measurement and perceptual theory to the specific measurement under consideration; the empirical evidence available for the feasibility of actually accomplishing the desired measurement; an analytic examination of the feasibility and appropriateness of the recommended technique that will have evolved from the above considerations; and finally, an overview of the current-state-of-measurements with relation to the instrumental requirements for the suggested approach. GRA

N74-21089# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.
PRESSURE-BOWL STRESS TESTS OF COATED FABRIC MATERIAL Interim Report, Sep. 1970 - Oct. 1972
Mark A. Dubois Nov. 1973 35 p
(DA Proj. 1G6-64717-DL-41)
(AD-774292; USAMERDC-2081) Avail: NTIS CSCL 13/4

The report describes the setup, operation, and results of stress tests of coated fabric material and vent-flange attachments used in self-supporting, collapsible fuel storage tanks. Coated fabric material was exposed to fuel saturated with water and subjected to a fabric stress of 51.8 pounds per inch. These tests were used in conjunction with laboratory tests and field tests to determine the effect of various environments and fuels on coated fabric material. Material stressed in a pressure-bowl apparatus did not produce the wet-spotting previously observed in 5000-barrel, collapsible fuel storage tanks but did allow determination of nylon and coating deterioration in coated fabric of various construction. Author (GRA)

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State.

N74-21090 Tennessee Univ., Knoxville.
AN INVESTIGATION OF THE INTERACTION OF LASER RADIATION WITH PLASMA ELECTRONS Ph.D. Thesis
John Francis Seely 1973 91 p
Avail: Univ. Microfilms Order No. 74-3866

The interaction of laser radiation with plasma electrons is investigated from a quantum mechanical viewpoint. The electromagnetic field of the laser beam is treated as a classical plane wave, and the plasma electrons are treated quantum mechanically. The absorption of laser radiation by multiphoton inverse Bremsstrahlung is considered. A kinetic equation is derived and the change in kinetic energy of the electrons is calculated. Effective collision frequencies are found for the two cases of weak field and strong field and are compared to the classical results. Finally, the solution to the Schrodinger equation for a particle in an electromagnetic wave and a parallel magnetic field is obtained. The production of positron-electron pairs in a laser beam is considered. Using the Volkov solutions to the Dirac equation, an expression for the cross section for pair production induced by the absorption of a gamma ray is derived. Dissert. Abstr.

N74-21091* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LONG RANGE LASER TRAVERSING SYSTEM Patent
Louis O. Caudill, inventor (to NASA) Issued 16 Apr. 1974 6 p Filed 14 Jul. 1971 Supersedes N72-21503 (10 - 12, p 1621)
(NASA-Case-GSC-11262-1; US-Patent-3,804,525; US-Patent-Appl-SN-162380; US-Patent-Class-356-152; US-Patent-Class-356-141; US-Patent-Class-356-172; US-Patent-Class-250-204; US-Patent-Class-33-285) Avail: US Patent Office CSCL 20E

The relative azimuth bearing between first and second spaced terrestrial points which may be obscured from each other by intervening terrain is measured by placing at one of the points a laser source for projecting a collimated beam upwardly in the vertical plane. The collimated laser beam is detected at the second point by positioning the optical axis of a receiving instrument for the laser beam in such a manner that the beam intercepts the optical axis. In response to the optical axis intercepting the beam, the beam is deflected into two different ray paths by a beam splitter having an apex located on the optical axis. The energy in the ray paths is detected by separate photoresponsive elements that drive logic networks for proving indications of: (1) the optical axis intercepting the beam; (2) the beam being on the left of the optical axis and (3) the beam being on the right side of the optical axis. Dissert. Abstr.

N74-21092 California Univ., Los Angeles.
REACTIVE Q-SWITCHED CARBON DIOXIDE LASER Ph.D. Thesis
Y.- C. Yeh 1973 121 p
Avail: Univ. Microfilms Order No. 74-3990

A reactive Q-switched CO2 laser was studied both experimentally and theoretically. The theoretical analysis included the effects of the relaxation between various vibration-rotational states on the system. These effects were lumped into a 3-level and a 9-level model. The calculations were carried out using numerical techniques by means of an IBM 360-91 computer. The 9-level model was found to give much closer agreement with the experimental observations. It should be noted that the 9-level model does not have more arbitrarily adjustable parameters than the 3-level model. That is, all of the additional rate constants and time constants that appear in the 9-level model are known constants. The sensitivity of the 9-level model to various rates and time constants is also demonstrated. Dissert. Abstr.

N74-21093 Oregon Univ., Eugene.
APPLICATIONS OF THE LASER TO MOLECULAR SPECTROSCOPY Ph.D. Thesis
Martin Charles Edelson 1973 157 p
Avail: Univ. Microfilms Order No. 74-6823

The pulsed ruby laser was employed in the Q-switched mode in order to study multiphoton absorption in a variety of materials. This low probability event is only observable with sources of high photon flux, such as the Q-switched laser. The special precautions necessary in the two-photon absorption studies of liquids are discussed, and are applied to the study of liquid alpha-chloronapthalene. The two-photon absorption spectrum of Strontium Titanate ($SrTiO_3$) is presented. The spectrum is analyzed in terms of band-to-band transitions and the two-photon band-gap energy is found to be ca. 3.8eV. A polarization study of the two-photon absorption at 4.00 eV is presented. An electronic optical spectrograph was constructed in order to obtain ultra-fast Raman spectra. This system utilizes the pulsed ruby laser as a highly monochromatic source of high radiance. A discussion is presented of the attempt to observe Raman scattering from the excited states of benzene and polyvinyl carbazole. Dissert. Abstr.

N74-21094 State Univ. of New York, Stony Brook.
LEVEL CROSSING SPECTROSCOPY IN CALCIUM, SODIUM AND BARIUM USING A PULSED TUNABLE DYE LASER Ph.D. Thesis
Peter Karl Schenck 1973 114 p
Avail: Univ. Microfilms Order No. 74-6746

The signal width of conventional level crossing experiments is limited by the natural width of the line. In order to reduce the signal width in our level crossing experiments, the observation of the resonance fluorescence is delayed after the excitation pulse provided by a pulsed tunable dye laser. The use of the dye laser excites enough atoms in a time short compared to the lifetime of the excited state, to allow the delay to be several lifetimes. The resonance fluorescence is then sampled for an interval short compared to the lifetime with a fast detector. The resulting signals are oscillatory in both magnetic field and the time delay. When the delay is several lifetimes the width of the level crossing signal is narrower than usually obtained in level crossing experiments employing continuous excitation and observation. These signals constitute time resolved level crossing signals. Dissert. Abstr.

N74-21095 Illinois Univ., Urbana.
APPLICATION OF TIME-RESOLVED LASER-EXCITATION FLUOROMETRY TO THE STUDY OF PRIMARY PHOTOSYNTHETIC PROCESSES Ph.D. Thesis
John Herndon Hammond 1973 134 p
Avail: Univ. Microfilms Order No. 74-5586

Gas lasers operating at discrete visible wavelengths were mode-locked to provide sources for pulsed excitation of various pigments in photosynthetic materials. The decay kinetics of in vivo molecular excited state populations produced by these sources were studied using both conventional and newly developed high time resolution fluorometric techniques. By choosing laser wavelengths which could selectively excite either chlorophyll a (Chl a) or an accessory pigment which could nonradiatively transfer its energy to Chl a, the time characteristics of energy migration between the two pigments are investigated. Dissert. Abstr.

N74-21096# Institut Franco-Allemand de Recherches, St. Louis (France).
INVESTIGATION OF HYPERSONIC FLIGHT PROJECTILES AND WAKES USING HOLOGRAPHIC METHODS Ph.D. Thesis - Besancon Univ., France [ETUDE DES PROJECTILES EN VOL HYPERSONIQUE ET DE LEURS SILLAGES PAR DES METHODES HOLOGRAPHIQUES]
Paul Smigielski 10 Oct. 1973 252 p refs In FRENCH; ENGLISH summary Sponsored by Direc. des Rech. et Moyens d'Essais
(ISL-24/73) Avail: NTIS HC $15.75

General considerations and basic principles concerning techniques used in the field of high-speed holography are dealt with including: advantage of high-speed photography in ballistic ranges over other, more conventional methods used so far; and influence of the object motion as well as of geometrical aberrations on the reconstructed image in realistic cases (uniform linear motion, changes occurring in the wavelength between hologram recording and image reconstruction, strong angular variations between reference beam, object beam, and normal to the hologram). The techniques used are described. Methods of visualizing wakes of projectiles were investigated. The wave reconstructed with the aid of holography was successively analyzed using differential interferometry in polarized light, schlieren techniques including a phase plate that is defocused with respect to the Fourier plane, and holographic interferometry with double exposure in directional light as well as diffused light. The theoretical and experimental results achieved in using the above mentioned methods in the ballistic range such as visualization of wakes and observation of the surface of hypersonic projectiles are presented. Author (ESRO)

N74-21097# Institut Franco-Allemand de Recherches, St. Louis (France).
QUALIFICATION OF FREEZING FOGS BY HOLOGRAPHY [QUALIFICATION DES BROUILLARDS GIVRANTS PAR HOLOGRAPHIE]
H. Royer 13 Sep. 1973 25 p In FRENCH
(Contract CEPR-72-0126)
(ISL-25/73) Avail: NTIS HC $4.25

Holographic data were recorded and processed under various conditions to develop a holographic method for the qualification of freezing fogs. It is shown that using a few fog injector numbers, the quality of images obtained was satisfactory even for the high water flow. In addition, the development of an electronic lens for the restitution system reduced the image data processing time in a 1/3 factor. ESRO

N74-21098# Institut Franco-Allemand de Recherches, St. Louis (France).
EXPERIMENTAL INVESTIGATION OF THE STIMULATED EMISSION IN THE ELECTRON BEAM EXCITED NITROGEN [ETUDE EXPERIMENTALE DE L'EMISSION STIMULEE DANS L'AZOTE EXCITE PAR FAISCEAU D'ELECTRONS]
F. Jamet and A. Hirth 8 Nov. 1973 19 p refs In FRENCH
(ISL-29/73) Avail: NTIS HC $4.00

A 750 kV (100 J) Marx generator connected to a discharge tube was used as an electron gun. The results of a parametric study of super radiant laser action at 337 nm in the second positive band system of molecular nitrogen with excitation by a 1300 A electron beam are reported. Laser output power up to 1 MW in a 2 nsec pulse was observed. In addition, tabulated data on nitrogen laser emission characteristics obtained by various authors using various electron guns are given. ESRO

N74-21099# Max-Planck-Institut fuer Physik und Astrophysik, Munich (West Germany). Inst. fuer Extraterrestrische Physik.
ENERGY DISTRIBUTION OF THE REACTIVE DISPERSION OF Ba AND Ba2 WITH OXYGEN [DIE ENERGIEVERTEILUNG DER REAKTIVEN STREUUNG VON Ba AND Ba2 MIT SAUERSTOFF]
Andreas Plagge Oct. 1973 140 p refs In GERMAN
(MPI-PAE-Extraterr-89) Avail: NTIS HC $10.00

The possibility of wave excited barium oxide forming a laser system was investigated theoretically. The energy distribution of the barium oxide formed was estimated as a function of the wave frequency. The Einstein coefficient for the spontaneous emission was calculated, and the amplification ratio was computed using the Ben-Shaul theory. The theory was tested in a suitable molecular beam apparatus. ESRO

N74-21100# Naval Ordnance Lab., White Oak, Md.
TEMPERATURE DEPENDENCE OF CO2 LASER RADIATION ABSORPTION IN SF6-AIR MIXTURES
Jerry Wagner 11 Oct. 1973 40 p refs
(AD-773447; NOLTR-73-179) Avail: NTIS CSCL 07/4

Experimental results for the temperature dependence of the 10.6 micrometer absorption coefficient of SF6-air mixtures are presented. A summary from previous works is also presented which provides complete variations of absorption coefficient with pressure, wavelength, and temperature. This fundamental physical data provides insight into the understanding of laser radiation absorption mechanisms in SF6-air mixtures. Author (GRA)

N74-21101# Maryland Univ., College Park. Dept. of Aerospace Engineering.
SENSITIVITY OF GASDYNAMIC LASER CALCULATIONS TO UNCERTAINTIES IN KINETIC RATES
John D. Anderson, Jr. Oct. 1973 57 p refs
(Grant AF-AFOSR-2575-74; AF Proj. 9750)
(AD-774135; AFOSR-74-0134TR; AEA73-2) Avail: NTIS CSCL 07/4

Recent data for the vibrational energy exchange rates associated with CO2-N2-H2O gas lasers is compared with previous compilatons. From this, current uncertainties in the rate data are established. Using an existing computer code, a study is made of the sensitivity of gasdynamic laser performance to these uncertainties. The results show that present-day calculations of gasdynamic laser gain and maximum available power are subject to at least a 25% inaccuracy due to such rate data uncertainties. Author (GRA)

N74-21102# Naval Research Lab., Washington, D.C.
STRIPLINE POCKEL'S CELL ASSEMBLY INSTRUCTIONS
Jules P. Letellier Jan. 1974 13 p ref
(ARPA Order 2062; NRL Proj. K03-08A)
(AD-774495; NRL-MR-2716) Avail: NTIS CSCL 20/5

The report contains a step-by-step assembly procedure for the Pockel's cells used in the NRL Glass Laser Facility. Also included are some repair notes. Author (GRA)

N74-21103# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

INVESTIGATION OF DIFFUSERS FOR GAS DYNAMIC LASER NOZZLES M.S. Thesis
David G. Clawson Dec. 1973 36 p refs
(AD-774391; GAM/ME/73A-3) Avail: NTIS CSCL 20/5

Schlieren photographs were used to analyze the flow characteristics of diffusers for a Mach 6.0 double nozzle assembly. This assembly of two nozzles, comprised of one (1) full center and two (2) half side channels, was more conducive to greater boundary layer growth than a nozzle assembly with more nozzle throats. Schlieren photographs of the air flow were in line with the laser beam's orientation to the nozzles of a Gas Dynamic Laser. Dry air at 85 F total temperature, and 120 psia total pressure was expanded with a nozzle area ratio of 66.0. Different diffuser configurations were tried to determine the diffuser throat area required to start the cavity. It was determined that the cavity would start when the ratio of diffuser throat area to channel cross-sectional area was near 0.6, which is in agreement with other studies, considering the presence of wakes in the flow. Boundary layer growth is accelerated at these high Mach numbers, limiting the distance between the nozzles and diffuser; excellent optical charity flow was obtained emerging from the nozzles and close to the channel center using a multi-element diffuser, but, deteriorates rapidly further downstream. Author (GRA)

N74-21104# Aerospace Corp., El Segundo, Calif. Aerophysics Lab.
ELECTRON BEAM IRRADIATED DISCHARGES CONSIDERED FOR INITIATING HIGH-PRESSURE PULSED CHEMICAL LASERS Report for Dec. 1972 - Apr. 1973
Robert Hofland, Martin L. Lundquist, Alfred Ching, and James S. Whittier 31 Oct. 1973 59 p refs
(Contract F04701-73-C-0074)
(AD-774095; TR-0074(9240-05)-1; SAMSO-TR-74-16) Avail: NTIS CSCL 20/5

Volumetric irradiation by a short-pulse electron beam has been used to trigger long-duration, spatially uniform electric discharges in gas mixtures of He and F2 or SF6. Uniform energy deposition to 300 J/liter has been observed for atmospheric F2-He mixtures at nominal e-beam currents of 3 A/sq cm and discharge currents up to 20 A/sq cm. Operation suitable for efficient initiation of pulsed HF/DF chain lasers appears possible over a wide range of E/N and mixture ratios, limited by breakdown at large E/N and negligible field enhancement at low E/N. Approximate analytical plasma models are presented and used in conjunction with time-resolved afterglow current measurements to obtain rate constants for F- ion-F2 ion recombination and F2- ion-electron recombination. Estimates of F2 dissociation fractions achieved in the experiments imply the possibility of scalable and efficient initiation of pulsed chemical lasers with such discharges. Author (GRA)

N74-21105# United Aircraft Corp., East Hartford, Conn. Research Labs.
NONDESTRUCTIVE HOLOGRAPHIC TECHNIQUES FOR STRUCTURES INSPECTION Annual Technical Report, 1 May 1972 - 30 Apr. 1973
R. K. Erf, J. P. Waters, R. N. Gagosz, K. A. Stetson, and G. Whitney Sep. 1973 98 p refs
(Contract F33615-71-C-1874; AF Proj. 7351)
(AD-774758; UARL-M991208-24; AFML-TR-73-193) Avail: NTIS CSCL 14/2

The program is an investigation of the feasibility of using holographic interferometry for the inspection of large aircraft structures in a manufacturing or maintenance environment. The second year's work comprised the following: an investigation of the effects of airborne particulates on the holographic process, a study of holographic methods suitable for the manufacturing or maintenance environment, an investigation and experimental demonstration of two new moire methods for the visualization of strain patterns, investigations of potential stress generating mechanisms, suitable for the holographic detection of cracks, in which it was experimentally demonstrated that surface waves can be generated and attenuated by cracks, and experimental demonstrations that illustrated the potential of holography, in combination with ultrasonic excitation, for solving cooling passage alignment inspection problems. (Modified author abstract) GRA

N74-21106# General Electric Co., Schenectady, N.Y.
THREE DIMENSIONAL DIAGNOSTIC TECHNIQUES - LASER VELOCIMETER HYPERSONIC VELOCITY MEASUREMENTS Final Report
J. C. F. Wang and J. A. Asher Dec. 1973 58 p refs
(Contract F33615-71-C-1867; AF Proj. 7065)
(AD-774755; ARL-73-0144) Avail: NTIS CSCL 14/2

The report describes a study of 3-D diagnostic techniques for measurements of flow velocity in the test section of a hypersonic wind tunnel. A successful on-site demonstration using a laser velocimeter system is discussed in detail. The close agreement between the LV and theoretical results demonstrates the feasibility of employing this technique in supersonic or hypersonic flow situations. Some technical experiences and considerations concerning the LV system as well as a few improvements for further development are also reported. (Modified author abstract) GRA

N74-21107# Texas Instruments, Inc., Dallas. Central Research Labs.
CHALCOGENIDE GLASSES FOR HIGH ENERGY LASER APPLICATIONS
A. R. Hilton, D. J. Hayes, and M. D. Rechtin Jan. 1974 67 p refs
(Contract N00014-73-C-0367; ARPA Order 2443)
(AD-774140; TI-08-74-06; TR-1) Avail: NTIS CSCL 20/5

Substantial reduction in the absorption at 10.6 micrometers is required before chalcogenide glasses can be used with high-energy CO2 lasers. In this program, new methods for compounding high-purity TI-1173 glass (composition Ge28-Sb12Se60) and TI-20 glass (composition Ge33As12Se55) were developed. At the present stage of purity, the absorption for TI-1173 at 10.6 micrometers is about 0.01/cm. The absorption is dominated by the silica content of the glass and can be lowered if the impurity is removed. The absorption for TI-20, however, is presently about 0.05/cm and is dominated by a broad, low-level absorption centered about 12.8 micrometers. The absorption appears to be intrinsic, and little can be done to improve TI-20 further. (Modified author abstract) GRA

N74-21108# Naval Research Lab., Washington, D.C.
HIGH ENERGY LASER WINDOWS Semiannual Report, 1 Jul. - 31 Dec. 1973
R. W. Rice 31 Dec. 1973 84 p refs
(ARPA Order 2031)
(AD-774701; SAR-3) Avail: NTIS CSCL 20/5

The goal of this program is to reduce the absorption, and improve the mechanical properties, of alkali halides for laser window use. During this reporting period, a number of important results in infrared absorption have been achieved: (1) Nearly intrinsic bulk absorption has been found at 10.6 micrometers in chemically polished KCl crystals which were grown in a reactive atmosphere; (2) Intrinsic and extrinsic absorption in KCl has been distinguished by studies of its temperature dependence; (3) A 9.8 micrometers surface impurity band in KCl has been detected by laser calorimetry; and, (4) Frequency and temperature dependence of absorption at wavelengths 10.6 micrometers has been studied with the spectral emittance studies at NELC. GRA

N74-21109# Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.
THE DESIGN OF A LASER DOPPLER VELOCIMETER FOR TRANSONIC FLOWS Interim Report, 26 Aug. 1971 - 30 Jun. 1973
Michael K. Pedigo and Warren H. Stevenson 29 Oct. 1973 99 p refs
(Contract DAAH01-72-C-0089; DA Proj. 1M2-62303-A-214)
(AD-774302; RD-73-25) Avail: NTIS CSCL 20/4

Design considerations for laser Doppler velocimeters suitable for transonic flow measurements are presented. The optical and mechanical elements of an instrument designed for such application are described in detail. The device is of the differential Doppler-backscatter configuration and uses an argon laser. Independent and simultaneous measurement of two orthogonal velocity components is accomplished by using both the 4880 and 5145 angstrom argon wavelengths. Results of preliminary velocity measurements in a two-dimensional transonic

nozzle and an open jet are presented to illustrate the performance of the velocimeter. Author (GRA)

N74-21110# General Electric Co., Philadelphia, Pa. Space Div.
INVESTIGATION OF HIGH POWER MHD GAS LASERS Annual Report, 1 Jan. - 31 Dec. 1973
Bert Zauderer, Eric Tate, and C. H. Marston 31 Dec. 1973 52 p refs Sponsored in part by ARPA
(Contract N00014-73-C-0243)
(AD-773975) Avail: NTIS CSCL 20/5

The primary objective of this year's effort, the achievement of optical gain in an MHD channel, has been met. Gain of 0.2%/cm at 10.6 micrometers has been repeatedly measured in two gas mixtures He/Ne/CO2/Xe and He/Ar/CO2/Cs. GRA

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N74-21111 Case Western Reserve Univ., Cleveland, Ohio.
YIELD STRESS AND SLIP ASYMMETRY IN TANTALUM-NITROGEN ALLOYS Ph.D. Thesis
George Lee Webb 1973 149 p
Avail: Univ. Microfilms Order No. 74-2574

The orientation dependence of both the yield stress and slip systems of pure tantalum and tantalum alloys containing up to approximately 500 atomic ppm nitrogen was investigated at 77 K and 197 K. Oriented single crystals were grown in a zone melter, and purified using a UHV solid state outgassing technique. Specimens with orientations -30 is less than or equal chi is less than or equal +30 were tested in tension and compression; slip trace analysis was done on many of the specimens. At 77 K, the yield stress is a minimum when chi = -30, and for any orientation, the yield stress in compression is greater than the yield stress in tension. At 197 K, for an orientation with chi = +30, the strength differential between tension and compression reversed, and the yield stress in tension was greater than the yield stress in compression. The rate of alloy hardening was found to be a strong function of orientation, nitrogen content, and also mode of testing (tension or compression).
Dissert. Abstr.

N74-21112 Michigan Univ., Ann Arbor.
MASS AND HEAT TRANSFER DURING DISSOLUTION OF A SOLID CYLINDER OF AN IRON-CARBON ALLOY INTO A LIQUID IRON-CARBON ALLOY Ph.D. Thesis
Yeong-U Kim 1973 183 p
Avail: Univ. Microfilms Order No. 74-3656

The rates of dissolution of a solid pure iron and a solid iron-carbon alloy into molten iron-carbon alloys were studied isothermally as a function of temperature, carbon content and ferrodynamic (stirring) conditions. Experiments were carried out in a resistance-heated tube furnace under an inert atmosphere of argon gas at temperatures ranging from 2165 F to 2563 F. A cylindrical specimen of the solid was preheated to the liquid temperature and immersed into the liquid bath contained in a graphite or alumina crucible at rotational speeds ranging from 0 to 1800 rpm. The dissolution rate was shown to be mass transfer controlled. The mass transfer coefficients were calculated with the assumptions that the reaction of phase transformation at the solid-liquid interface was fast enough to maintain the equilibrium compositions at the solid temperature with an appropriate heat supply from the bulk liquid for the latent heat of phase transformation, and that the dissolution rate was controlled by diffusion in a boundary layer and the bulk liquid was maintained at a uniform composition by convective motion in the liquid. Dissert. Abstr.

N74-21113 Illinois Univ., Urbana.
THE PHASE TRANSITION OF A COBALT-NICKEL ALLOY Ph.D. Thesis
William Francis Weston 1973 92 p
Avail: Univ. Microfilms Order No. 74-5732

A cubic single crystal of cobalt-31% nickel was transformed to a hexagonal single crystal. The univariant transformation was accomplished by prestressing a cubic crystal until single slip was observed and cooling to liquid nitrogen temperature. Evidence that the transformed specimen was a hexagonal single crystal was obtained from Laue X-ray photographs, surface markings analysis of the magnitude of sound wave velocities and the symmetry of their polarizations, and the magnetic field dependence of the attenuation of certain modes. Complete sets of second- and third-order elastic constants (except for C13) of both phases were determined experimentally from measurements of the natural sound velocities and hydrostatic pressure and uniaxial compression stress derivatives of the natural sound velocities. A gated pulse superposition technique was used. The C13 could not be determined experimentally because of the orientations of the hexagonal crystal. A procedure based on a simple rotation of the cubic constants was used to estimate C13. Dissert. Abstr.

N74-21114 Brown Univ., Providence, R.I.
FLUCTUATION-INDUCED DIAMAGNETISM IN ALUMINUM AND ITS ALLOYS Ph.D. Thesis
Harvey Lewis Kaufman 1973 130 p
Avail: Univ. Microfilms Order No. 74-3035

Observations of the enhanced diamagnetism in bulk, cylindrical single crystals of pure aluminum and its alloys are reported. The impurity in all cases is silver. The diamagnetism occurs above the thermodynamic normal-superconductor transition temperature and is attributed to the formation of an appreciable number of Cooper pairs by means of fluctuations in the superconducting order parameter. Anomalous surface effects were also present in a number of dirty alloys. This effect is represented by a diamagnetic magnetization well in excess, by at least an order of magnitude, of that expected from the bulk fluctuations alone. It was found, however, that upon careful electropolishing of the surface and subsequent electroplating of a normal metal onto the alloy, the broadening was reduced to the extent that the bulk fluctuation magnetization was clearly observable.
Dissert. Abstr.

N74-21115 Illinois Univ., Urbana.
A STUDY OF METAL-OXYGEN SOLID SOLUTIONS UTILIZING SOLID ELECTROLYTIC CELLS Ph.D. Thesis
William Joseph Nickerson 1973 129 p
Avail: Univ. Microfilms Order No. 74-5648

A thermodynamic study was made of the niobium-oxygen, tantalum-oxygen, niobium-oxygen-nitrogen, and tantalum-oxygen-nitrogen systems utilizing the solid state galvanic cell technique. Investigations were made over the temperature range 850 to 1275 C in a pressure range of low 10 to the -7th power to 10 to the -8th power torr utilizing a ThO2/Y2O3 electrolyte. Some preliminary results for the activation energy for diffusion of oxygen in nickel and niobium are reported. The terminal solubility of oxygen in niobium and tantalum are determined. Ternary nitrogen additions up to about 1.5 at.% are found to have little effect on the oxygen terminal solubility and related thermodynamics. It is concluded that oxygen obeys Henry's law for the temperatures of this investigation for concentrations up to the terminal solubility. No significant clustering or interactions between interstitial solute atoms are detected in either the binary or ternary systems. Dissert. Abstr.

N74-21116*# Stanford Univ., Calif.
LIQUID METAL EMBRITTLEMENT Final Technical Report
William A. Tiller 1 Nov. 1973 30 p refs
(Grant NGR-05-020-549)
(NASA-CR-137429; SU-DMS-74-R-32) Avail: NTIS HC $4.50 CSCL 11F

Crack propagation is discussed for metals with liquid metal in the crack space. The change in electrochemical potential of an electron in a metal due to changes in stress level along the crack surface was investigated along with the change in local chemistry, and interfacial energy due to atomic redistribution in the liquid. Coupled elastic-elastrostatic equations, stress effects on electron energy states, and crack propagation via surface roughening are discussed. F.O.S.

N74-21117# Joint Publications Research Service, Arlington, Va.
HIGH STRENGTH NONMAGNETIC ALLOYS
V. S. Ivanova, ed. 29 Mar. 1974 123 p refs Transl. into ENGLISH of the publ. "Vysokoprochnyye Nemagnitnyye Splavy" Moscow, 1973 p 5-113
(JPRS-61605) Avail: NTIS HC $9.25

Basic properties of precipitation- and phase work-hardened, nonmagnetic high strength alloys are considered. For individual titles, see N74-21118 through N74-21133.

N74-21118 Joint Publications Research Service, Arlington, Va.
PHASE WORK HARDENING OF AUSTENITIC STEELS
K. A. Malyshev *In its* High Strength Nonmagnetic Alloys (JPRS-61605) 29 Mar. 1974 p 4-10 refs Transl. into ENGLISH from the publ. "Vysokoprochnyye Nemagnitnyye Splavy" Moscow, 1973 p 5-12 (For availability see N74-21117 12-17)

Problems of the hardening of austenitic alloys of iron, nickel and titanium by phase work hardening and aging are discussed. The role of phase work hardening before aging, in increasing the strength of austenite, and in developing a substructure that insures the most favorable distribution of the hardening phase during subsequent aging, is established. Author

N74-21119 Joint Publications Research Service, Arlington, Va.
RESEARCH ON LOW-MAGNETIC STRUCTURAL IRON ALLOYS FOR OPERATION AT ORDINARY, LOW AND HIGH TEMPERATURES AND UNDER CONDITIONS OF SHF RADIATION
Yu. K. Kovneristyy *In its* High Strength Nonmagnetic Alloys (JPRS-61605) 29 Mar. 1974 p 11-26 refs Transl. into ENGLISH from the publ. "Vysokoprochnyye Nemagnitnyye Splavy" Moscow, 1973 p 12-28 (For availability see N74-21117 12-17)

The fundamental problems of investigation, research and development of low magnetic, high strength iron alloys are presented in this article. The results of experimental studies of steels and alloys, obtained from electron microscopy, X-ray diffraction analysis and other methods of structural analysis are analyzed. The possibility of doing theoretical calculations for the purpose of evaluating strength and electromagnetic properties is demonstrated. The principles of alloying and hardening of low magnetic alloys for various purposes are analyzed, and ways of optimizing the properties of strength, impact toughness and electromagnetic properties are indicated. Author

N74-21120 Joint Publications Research Service, Arlington, Va.
EFFECT OF ALLOYING OF GAMMA-SOLID SOLUTION ON AGING PROCESSES IN AUSTENITIC STEELS
O. A. Bannykh *In its* High Strength Nonmagnetic Alloys (JPRS-61605) 29 Mar. 1974 p 27-32 refs Transl. into ENGLISH from the publ. "Vysokoprochnyye Nemagnitnyye Splavy" Moscow, 1973 p 28-33 (For availability see N74-21117 12-17)

It is shown that alloying of gamma-solid solutions of Ni, Mn and Mn-Ni of austenitic steels with elements that are not present in the carbide phase has a considerable influence on the precipitation of carbide VC. In this connection, by changing the chemical composition of the austenitic matrix it is possible to change in a wide range the relation between strength, plasticity and impact toughness after aging for maximum hardness. Definite relationships are found to exist between the concentration of nickel, manganese, chromium, aluminum, silicon, vanadium and carbon and the relative change of mechanical properties during aging of the above stated types of steel. Author

N74-21121 Joint Publications Research Service, Arlington, Va.
ELECTRON-MICROSCOPIC STRUCTURAL ANALYSIS OF HIGH-STRENGTH NONMAGNETIC STEELS
V. M. Blinov and Yu. K. Kovneristyy *In its* High strength Nonmagnetic Alloys (JPRS-61605) 29 Mar. 1974 p 33-46 refs Transl. into ENGLISH from the publ. "Vysokoprochnyye Nemagnitnyye Splavy" Moscow, 1973 p 33-46 (For availability see N74-21117 12-17)

Electron microscopic analysis of foils of high strength nonmagnetic steels revealed that the basic hardening phase of these steels are uniformly distributed carbide VC grains, 100-300A in diameter at a distance apart of 100-500A. Coarse Mn22c6 particles, which precipitate primarily along grain boundaries, have linear dimensions one order of magnitude greater than dispersed vanadium carbides and consist of thin parallel plates about 0.35 micron wide. The presence of near boundary areas after aging is established; coarse carbide particles form near such areas after long term aging. The investigated microstructures in the state of maximum hardening feature the formation of wide bands of packing defects, on which there is a large amount of uniformly distributed fine particles of VC. Author

N74-21122 Joint Publications Research Service, Arlington, Va.
THERMOMECHANICAL STRENGTHENING OF AUSTENITIC AGING STEELS
A. I. Uvarov and K. A. Malyshev *In its* High Strength Nonmagnetic Alloys (JPRS-61605) 29 Mar. 1974 p 47-53 refs Transl. into ENGLISH from the publ. "Vysokoprochnyye Nemagnitnyye Splavy" Moscow, 1973 p 46-53 (For availability see N74-21117 12-17)

The dependence of the mechanical properties and structures of aging steels on two forms of treatment is analyzed for: (1) Cold plastic deformation to 20 - 30% and subsequent aging in the temperature range of 20 - 800 deg; and (2) aging in the same temperature range as in the first version of treatment, and subsequent deformation at the aging temperature. It is established that the order of the processes of aging and plastic deformation are very important for the production of high strength steels. Author

N74-21123 Joint Publications Research Service, Arlington, Va.
PHASE HARDENING OF AUSTENITIC STAINLESS STEELS
V. V. Sagaradze and K. A. Malyshev *In its* High Strength Nonmagnetic Alloys (JPRS-61605) 29 Mar. 1974 p 54-60 refs Transl. into ENGLISH from the publ. "Vysokoprochnyye Nemagnityye Splavy" Moscow, 1973 p 53-59 (For availability see N74-21117 12-17)

The feasibility of hardening austenitic metastable stainless steels by direct and reverse martensite transformation is examined. The investigated stainless steels have isothermal gamma yields alpha kinetics and are greatly inclined toward thermal stabilization. The reverse gamma yields alpha transformation in stainless steels exhibits the basic attributes of the martensite transformation, complicated by the development of competing diffusion processes. Alloying of chromium nickel stainless steels with 2 - 3 % W, Mo, Nb, Ti and V delays the development of softening diffusion processes and greatly increases the effectiveness of phase hardening. Author

N74-21124 Joint Publications Research Service, Arlington, Va.
FURNACE AND IONIC NITRIDING OF LOW-MAGNETIC STEELS IN DIFFERENT GASES
Yu. M. Lakhtin, O. I. Butenko, D. P. Shashkov, Yu. N. Krymskiy, and T. M. Maltseva *In its* High Strength Nonmagnetic Alloys (JPRS-61605) 29 Mar. 1974 p 61-68 refs Transl. into ENGLISH from the publ. "Vysokoprochnyye Nemagnitnyye Splavy" Moscow, 1973 p 60-67 (For availability see N74-21117 12-17)

The feasibility of case hardening of low magnetic steels by nitriding and the effect of the saturation method and composition of the saturating gas on the properties of nitrided surface, are investigated. The method of vacuum extraction and melting of the investigated metal was used for determining the concentration of oxygen and hydrogen in the diffusion layers. It is shown that the concentration of impurity gases in the nitrided layer is higher for furnace saturation than for ionic saturation. The relationship between gas saturation and the degree of embrittlement of the layer is established. Author

N74-21125 Joint Publications Research Service, Arlington, Va.
CASE HARDENING OF HIGH-STRENGTH NONMAGNETIC STEELS
V. M. Blinov, Yu. K. Kovneristyy, R. M. Volkova, V. A. Rudman, and Yu. V. Sorokin *In its* High Strength Nonmagnetic Alloys (JPRS-61605) 29 Mar. 1974 p 69-77 refs Transl. into ENGLISH from the publ. "Vysokoprochnyye Nemagnitnyye Splavy" Moscow, 1973 p 68-77 (For availability see N74-21117 12-17)

The characteristics of case hardening after nitriding and surface work hardening of nonmagnetic precipitation hardening steels based on the systems Fe-Mn, Fe-Mn-Ni and Fe-Mn-Cr, are investigated. It is shown that high strength nonmagnetic steel after nitriding produces surface layers with high hardness

and a depth of up to 0.3 mm. Case hardening of low nitrided steel by rolling and shot peening increases the fatigue limit of unnotched specimens by 25 - 30 %, and of notched specimens by 90 - 140 %. Such an increase of fatigue strength is attributed to high surface hardness and compressive stresses in the surface layer. Author

N74-21126 Joint Publications Research Service, Arlington, Va.
ON THE CAUSES OF THE REDUCTION OF MECHANICAL STRENGTH OF NITRIDED LAYER OF MANGANESE AUSTENITIC STEELS
A. L. Nemchinskiy and T. F. Frey *In its* High Strength Nonmagnetic Alloys (JPRS-61605) 29 Mar. 1974 p 78-85 Transl. into ENGLISH from the publ. "Vysokoprochnyye Nemagnitnyye Splavy" Moscow, 1973 p 77-83 (For availability see N74-21117 12-17)

The presence of a visible network on grain boundary after nitriding of manganese austenitic steel at high temperature (750 C) decreases the mechanical strength of the nitrided layer. The causes of the formation of the visible network are established. It consists of nonmetallic inclusions, sulfides of manganese and oxides of the spinel type, which form as a result of diffusion of sulfur and oxygen from the gas environment during nitriding or cooling after nitriding. Author

N74-21127 Joint Publications Research Service, Arlington, Va.
PHYSICOMECHANICAL PROPERTIES OF HIGH-STRENGTH NONMAGNETIC STEELS OF THE TYPE 45G14N9F
Yu. K. Kovneristyy, V. M. Blinov, Ya. Ya. Vlasov, V. M. Doronin, A. M. Uglova, O. A. Plyatskovskiy, and O. G. Khokhlov-Nekrasov *In its* High Strength Nonmagnetic Alloys (JPRS-61605) 29 Mar. 1974 p 86-92 Transl. into ENGLISH from the publ. "Vysokoprochnyye Nemagnitnyye Splavy" Moscow, 1973 p 84-90 (For availability see N74-21117 12-17)

The physicomechanical properties of high strength nonmagnetic steels are investigated. Results show that the investigated steels are superior in terms of mechanical properties of nonmagnetic steels presently in use. High plasticity of the steels at high temperatures makes it possible to produce high strength nonmagnetic tubes and complex stampings. Author

N74-21128 Joint Publications Research Service, Arlington, Va.
ON THE FATIGUE STRENGTH OF PRECIPITATION HARDENING NONMAGNETIC STEELS
V. A. Rudman *In its* High Strength Nonmagnetic Alloys (JPRS-61605) 29 Mar. 1974 p 93-99 refs Transl. into ENGLISH from the publ. "Vysokoprochnyye Nemagnitnyye Splavy" Moscow, 1973 p 90-96 (For availability see N74-21117 12-17)

Fatigue strength of various precipitation hardening nonmagnetic steels is investigated. It is shown that the fatigue strength of nonmagnetic steels depends to a greater extent on the method and conditions of surface treatment than that of ordinary structural steels. Residual stresses that occur on the surface of the metal after any surface treatment exert the basic influence on the fatigue strength of nonmagnetic steels. The relationship between the fatigue strength of steels, sensitivity to notching and maximum elongation is established. Author

N74-21129 Joint Publications Research Service, Arlington, Va.
FEATURES OF PHASE COMPOSITION AND PROPERTIES OF PRECIPITATION HARDENING AUSTENITIC STEELS 9G28Yu9MVB
M. F. Alekseyenko, G. S. Krivonogov, L. G. Kozyreva, I. M. Kochanova, and L. V. Arapova *In its* High Strength Nonmagnetic Alloys (JPRS-61605) 29 Mar. 1974 p 100-104 refs Transl. into ENGLISH from the publ. "Vysokoprochnyye Nemagnitnyye Splavy" Moscow, 1973 p 96-100 (For availability see N74-21117 12-17)

The phase composition and properties of steel with low density are presented. The magnetometric method made it possible to do a quantitative analysis of delta-ferrite and (Fe, Mn)3AlCx phases. The kinetics of impoverished surface layer growth at high heating temperatures in air are explained. Author

N74-21130 Joint Publications Research Service, Arlington, Va.
PERFORMANCE AND TECHNOLOGICAL PROPERTIES OF CERTAIN LOW-MAGNETIC STEELS AND ALLOYS
Ya. Ya. Vlasov and Ye. I. Bozhenok *In its* High Strength Nonmagnetic Alloys (JPRS-61605) 29 Mar. 1974 p 105-107 Transl. into ENGLISH from the publ. "Vysokoprochnyye Nemagnitnyye Splavy" Moscow, 1971 p 101-102 (For availability see N74-21117 12-17)

The application of several low magnetic steels and alloys for making internal combustion engine parts is discussed. Comparative tests on physico-mechanical and technological properties of steels and titanium alloys revealed that high strength nonmagnetic steels and titanium alloys have the best combination of properties. Tests conducted on parts made of these metals in an engine confirmed their reliability. Author

N74-21131 Joint Publications Research Service, Arlington, Va.
THE SPREADING OF FATIGUE CRACKS IN NICKEL AND STEEL 1Kh18N9T **c32**
S. Ye. Gurevich and L. D. Yedidovich *In its* High Strength Nonmagnetic Alloys (JPRS-61605) 29 Mar. 1974 p 108-112 refs Transl. into ENGLISH from the publ. "Vysokoprochnyye Nemagnitnyye Splavy" Moscow, 1973 p 105-106 (For availability see N74-21117 12-17)

The endurance of flat specimens of nickel and steel during cyclic bending is investigated. It is established that the lower the packing defect energy of the metal is, the larger the number of fatigue cracking cycles becomes. Plotting of the dependence of the growth rate of a fatigue crack on the coefficients of stress and shear deformations at the apex of the crack revealed that the identical rate is achieved in the metal with the higher PDE (nickel) and smaller coefficients. Author

N74-21132 Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF AUSTENITIC CAST IRONS FOR DIESEL ENGINE PARTS
V. I. Laguta and V. B. Lebedev *In its* High Strength Nonmagnetic Alloys (JPRS-61605) 29 Mar. 1974 p 113-118 refs Transl. into ENGLISH from the publ. "Vysokoprochnyye Nemagnitnyye Splavy" Moscow, 1973 p 107-111 (For availability see N74-21117 12-17)

The physico-mechanical and technological properties, and also the heat resistance and growth stability of low magnetic nickel-manganese cast iron, used for diesel engine parts, operating under conditions of thermocyclic stresses, are examined. Mathematical planning of experiments is used for determining nonlinear mathematical models that show the dependence of magnetic permeability and heat resistance of nickel-manganese cast iron on the concentration of manganese, nickel and aluminum. Data on the properties of nickel-free cast iron are presented. Author

N74-21133 Joint Publications Research Service, Arlington, Va.
NONMAGNETIC ALLOYS WITH SUPERHIGH FREQUENCY ABSORPTION PROPERTIES
Yu. K. Kovneristyy and N. M. Shafir *In its* High Strength Nonmagnetic Alloys (JPRS-61605) 29 Mar. 1974 p 119-121 refs Transl. into ENGLISH from the publ. "Vysokoprochnyye Nemagnitnyye Splavy" Moscow, 1973 p 111-113 (For availability see N74-21117 12-17)

The absorption properties of heterogeneous austenitic iron alloys with Al2O2 oxides in the SHF range are determined. The dependence of SHF energy absorption in heterogeneous alloys on their composition and microstructure is established. Author

N74-21134*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF ISOTHERMAL AND CYCLIC OXIDATION BEHAVIOR OF TWENTY-FIVE COMMERCIAL SHEET ALLOYS AT 1150 C
Charles A. Barrett and Carl E. Lowell Washington Apr. 1974 52 p refs
(NASA-TN-D-7615; E-7629) Avail: NTIS HC $3.75 CSCL 11D

The cyclic and isothermal oxidation resistance of 25 high-temperature Ni-, Co-, and Fe-base sheet alloys after 100 hours in air at 1150 C was compared. The alloys were evaluated in terms of their oxidation, scaling, and vaporization rates and their tendency for scale spallation. These values were used to develop an oxidation rating parameter based on effective thickness change, as calculated from a mass balance. The calculated thicknesses generally agreed with the measured values, including grain boundary oxidation, to within a factor of 3. Oxidation behavior

was related to composition, particularly Cr and Al content.
Author

N74-21135*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EVALUATION OF TANTALUM-ALLOY-CLAD URANIUM MONONITRIDE FUEL SPECIMENS FROM 7500-HOUR, 1040 C PUMPED-LITHIUM-LOOP TEST
Gordon K. Watson Washington Apr. 1974 35 p refs
(NASA-TN-D-7619; E-7753) Avail: NTIS HC $3.25 CSCL 11F

Simulated nuclear fuel element specimens, consisting of uranium mononitride (UN) fuel cylinders clad with tungsten-lined T-111, were exposed for up to 7500 hr at 1040 C (1900 F) in a pumped-lithium loop. The lithium flow velocity was 1.5 m/sec (5 ft/sec) in the specimen test section. No evidence of any compatibility problems between the specimens and the flowing lithium was found based on appearance, weight change, chemistry, and metallography. Direct exposure of the UN to the lithium through a simulated cladding crack resulted in some erosion of the UN in the area of the defect. The T-111 cladding was ductile after lithium exposure, but it was sensitive to hydrogen embrittlement during post-test handling. Author

N74-21136*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
STRESS CORROSION CRACKING SUSCEPTIBILITY OF 18 Ni MARAGING STEEL
T. S. Humphries and Eli E. Nelson Apr. 1974 26 p refs
(NASA-TM-X-64837) Avail: NTIS HC $4.50 CSCL 11F

The stress corrosion cracking (SCC) resistance of 18Ni maraging steel (grades 200, 250, 300, and 350) was determined in 3.5 percent salt (NaCl) solution, synthetic sea water, high humidity, and outside MSFC atmosphere. All grades of the maraging steel were found to be susceptible to SCC in varying degrees according to their strengths, with the lowest strength steel (grade 200) being the least susceptible and the highest strength steel (grade 350), the most susceptible to SCC. The SCC resistance of 250 grade maraging steel was also evaluated in salt and salt-chromate solutions using fracture mechanics techniques. The threshold value, K sub SCC, was found to be approximately 44 MN/sq m square root m, (40 ksi square root in.) or 40 percent of the K sub Q value. Author

N74-21137# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
OPTIMAL CONTROL OF A DEGENERATE MARKOVIAN SYSTEM
M. H. A. Davis Sep. 1972 18 p refs Presented at the IMA Conf. on Recent Math. Develop. in Control, Bath, Engl., 5-7 Sep. 1972
(Publ-72/29) Avail: NTIS HC $4.00

Conditions are given for the existence of an optimal control policy for a system described by stochastic differential equations of a specified form. The control vector takes value in a metric space and, for a given control function, there exists a Markov process with degenerate (non uniformly elliptic) differential operator - the control policy is chosen so as to minimize a given cost function. The solution is based on a theorem giving the representation of a value function which is defined and which relies on supermartingale theory. The Girsanov transformation technique is used. A theorem is demonstrated stating that, for the given problem, an optimal control policy exists which is optimal in the class of all controls depending on the complete past of the process. It is obtained by minimizing a specified Hamiltonian function. ESRO

N74-21138# Magnesium Elektron Ltd., Swinton (England).
EVALUATION OF THE DOW 17 TREATMENT FOR MAGNESIUM ALLOYS
K. G. Adamson, J. F. King, and W. Unsworth London Min. of Defence Feb. 1973 44 p refs
(Contract KS/1/0570/G.B.43(a)2)
(D-MAT-192; BR38304) Avail: NTIS HC $5.25

The operating parameters for the Dow 17 surface treatment of magnesium alloys were determined. The cleaning effect of Dow 17 was compared with that of fluoride anodizing. The results obtained were not consistent, but suggest that no significant deleterious effect would result from substituting a 1.0 mil thick Dow 17 treatment for fluoride anodizing, chromic acid stripping and chromating. Various thicknesses of Dow 17 pretreatment were compared with standard DTD 911C pretreatment. The assessment included corrosion tests on the various pretreatments with surface sealing, painting to DTD 5580, and a full DTD 911C procedure. Results indicate that Dow 17 pretreatments in excess of 1.0 mil thick were as good as the DTD 911C pretreatment. The effect of various thicknesses of Dow 17 coatings on the fatigue strength of ZW3 and RZ5 alloys was determined under rotating bending conditions. Significant reductions in the fatigue strength of ZW3 were observed with increasing thickness of Dow 17. Author (ESRO)

N74-21139# Ministry of Defence, London (England).
MATERIALS FOR AEROSPACE CURRENT RESEARCH AND DEVELOPMENT
Jun. 1973 18 p
(D-MAT-194; BR38205) Avail: NTIS HC $4.00

Current trends in materials research and development are outlined with particular regard to airframe materials, engine metals, and nonmetallic materials. Progress in a wide range of metallic and nonmetallic materials required for airframes and aeroengines is briefly reviewed. ESRO

N74-21140# Defence Research Information Centre, Orpington (England).
STUDY OF THE HARDENING OF FERRITIC AND MARTENSITIC ALLOYS Fe-Mn-Ti
J. Manenc Dec. 1973 21 p refs Transl. into ENGLISH from Mem. Sci. Rev. Met. (Paris), v. 68, no. 4, 1971 p 761-769
(DRIC-Trans-3391; BR30689) Avail: NTIS HC $4.25

The effect of manganese on the hardening action of titanium in iron was studied by means of six alloys prepared by fusion under vacuum, cast in an argon atmosphere, and containing varying amounts of manganese and titanium. The samples were homogenized at 1200 C for 16 hours and then quenched with water. Tensile tests were made, transformation points measured, and the structure studied. During quenching, it was found that the samples containing ferrite did not change, but those containing austenite changed into martensite. The precipitation hardening of the various samples is discussed in detail. It was concluded that while ferrite samples are capable of intense hardening, martensitic alloys harden by ageing slowly and are not comparable. ESRO

N74-21141# Institut fuer Festkoerpermechanik, Freiburg (West Germany).
METALLOGRAPHIC INVESTIGATIONS OF INITIATION AND PROPAGATION OF MICROCRACKS IN DYNAMICALLY LOADED ARMCO-IRON [METALLOGRAPHISCHE UNTERSUCHUNG DER ENTSTEHUNG UND AUSBREITUNG VON MIKRORISSEN IN DYNAMISCH BELASTETEM REINEISEN (ARMCO-EISEN)]
G. Sperl and S. Winkler Sep. 1973 54 p refs In GERMAN
(WB-8/73) Avail: NTIS HC $5.75

The crack behavior of impact or shock loaded armco iron was investigated. The results of notch impact-bending tests were compared with impact tests with pressures between 8 and 40 kbar. Crack formation near the notch impact ductility-transition range was compared with the internal tensite stress crack formation in plane plates after after bombarding. Light and scanning electron microscopy was used for investigating the cracks. ESRO

N74-21142# European Space Research Organization, Paris (France).
METALLURGICAL AND ELECTRO-CHEMICAL ASPECTS OF STRESS CORROSION CRACKING OF TITANIUM ALLOYS
Alain Vassel Jan. 1974 91 p refs Transl. into ENGLISH of Facteurs Metallurgiques et Electrochim. de la Corrosion sous Contrainte des Alliages de Titane, ONERA-P-145, ONERA, 1972
(ESRO-TT-5; ONEAR-P-145) Avail: NTIS HC $7.75

Linear elastic fracture mechanics is applied to the study of stress corrosion cracking in saline water of two industrial titanium alloys: TA6V and TU2. TU2 alloy was found quite insensitive to cracking in the corrodent, quenched, and aged states. It is shown

that it is possible to make TA6V alloy nearly insensitive to stress corrosion cracking by heating in the beta range before a useful quenching and aging treatment. The electron microautoradiography technique of tritium established that the mechanism of crack propagation in saline water is a form of hydrogen embrittlement. Author (ESRO)

N74-21143# European Space Research Organization, Paris (France).
PHASE TRANSFORMATIONS IN THE TITANIUM ALLOY TiAl6V4
Majda Majdic et al Feb. 1974 65 p refs Transl. into ENGLISH of Phasenumwandlungen in der Titanlegierung TiAlV4, DLR-FB-73-38, DFVLR, 1973
(ESRO-TT-24; DLR-FB-73-38) Avail: NTIS HC $6.25; DFVLR, Porz.: 20.50 DM

Microstructure effects on fluctuation compensation in concentration and on martensite formation were studied with two charges of TiAl6V4. This titanium alloy differed in amounts, grain size, and morphology of the beta phase. The kinetics of the phase transformations are summarized in isothermal and continuous TTT plots. Author (ESRO)

N74-21144# British Steel Corp., Sheffield (England). Information Services.
BIBLIOGRAPHY ON POWDER METALLURGY Open Report
A. M. Healey Oct. 1973 150 p refs
(PB-225705/3GA; CDL/inf/2/73) Avail: NTIS HC $4.50 CSCL 11F

This bibliography contains 749 references which were selected from the published literature during the approximate period January 1972 to March 1973 originally for inclusion in Corporate Laboratories internally circulated Powder Metallurgy Bulletins. The subject content relates predominantly to ferrous metallurgy and deals with all stages in the processing from production of the powder through to application and properties of the powder metallurgy parts. GRA

N74-21145# Naval Ship Research and Development Center, Annapolis, Md.
ADHESIVE AND ADHESIVE PROPERTIES OF OXIDE-FREE METAL SURFACES: WATER ON COPPER AND SILVER
Malcolm E. Schrader Feb. 1974 14 p refs
(AD-773755; NSRDC-4171; NSRDC-28786) Avail: NTIS CSCL 07/4

The hydrophilic/hydrophobic properties of clean surfaces of copper and silver were investigated. Contact angles of oxygen-free water on clean, oxygen-free copper and silver surfaces were measured and found to be zero degrees. The introduction of very small amounts of organic contaminants to these surfaces, however, sufficed to make them hydrophobic. The results indicated that both the hydrophilicity of oxide-free metal surfaces and their especially strong affinity for hydrophobic low energy organic absorbates, are general characteristics of the metals of Group 1-b, and possibly of all metals. The latter characteristic hold promise for producing a variety of surfaces useful for applications involving reduced fluid-solid surface interaction. (Modified author abstract) GRA

N74-21146# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
MAGNETIC PROPERTIES OF AMORPHOUS ALLOYS. 1: Co-P. 2: Ni-P
D. Pan and D. Turnbull Jan. 1974 46 p refs
(Contract N00014-67-A-0298-0036; NR Proj. 032-544)
(AD-774716; TR-1) Avail: NTIS CSCL 11/6

Amorphous Co-P alloys, with compositions ranging between 18-25 a/o of P, were prepared by electrodeposition. Their magnetic properties were measured with a vibrating sample magnetometer between 4 and 520K in fields up to 8 Koe. The coercive force and ratio of remanence to saturation magnetization, of the alloys were several hundred times lower for the amorphous than for their as-crystallized states. The magnetic properties of electrodeposited amorphous Ni-P alloys, with P contents ranging from 12-23 a/o, were measured on a Foner-vibrating sample magnetometer in fields up to 8 Koe between 70 and 370K. Ferromagnetic Curie temperatures, Tc, determined by the method of thermodynamic parameters were found to decrease from 212 to 75K as x sub p increases from 12.41 to 16.77 a/o. The results indicate that at x sub p about 16 18 amorphous Ni-P alloys behave as weak itinerant ferromagnets. (Modified author abstract) GRA

N74-21147# Michigan Technological Univ., Houghton. Dept. of Metallurgical Engineering.
ASYMMETRICAL MECHANICAL BEHAVIOR OF A PRECIPITATION HARDENED BETA TITANIUM ALLOY
Steven M. Tuominen and Donald A. Koss Jan. 1974 20 p refs
(Contract N00014-72-A-0377-0001; NR Proj. 031-756)
(AD-774759; TR-1) Avail: NTIS CSCL 11/6

Precipitation hardened single crystals of a beta (bcc) Ti - 40 a/o V + 1.0 a/o Si alloy were deformed in compression at 77K and 298K. The dependence of the yield stress upon aging time at 570C for solutionized and quenched crystals shows two maxima, caused by the formation of silicide precipitates. The orientation dependence of the yield stress and of the active macroscopic slip plane were determined as a function of aging time. The results indicate that the effect of the dislocation core structure on dislocation motion is independent of the presence of precipitates. The results also suggest that matrix hardening is independent of and additive to precipitation hardening. (Modified author abstract) GRA

N74-21148# Naval Research Lab., Washington, D.C.
STRESS CORROSION CRACKING PROPERTIES OF TWO ALUMINUM-MAGNESIUM ALLOYS
F. D. Bogar and C. I. Fujii Jan. 1974 14 p refs
(NRL Proj. M01-30; ZF54544002)
(AD-774496; NRL-MR-2724) Avail: NTIS CSCL 11/6

The SCC behavior of two Alcoa Al-Mg alloys -- a commercial alloy, 5456-H117, and an experimental alloy, N-H117, is described. These materials were studied in the as-received and aged conditions for susceptibility to cracking in 3.5% NaCl solution. Double cantilever beam specimens were machined from the one-inch thick plates of the two alloys in the SL, TL, and LT orientations. All of the specimens were fatigue pre-cracked to facilitate initiation of a pop-in crack when bolt loaded to start the SCC tests. After three days immersion in the corrodent, the specimens were mechanically broken apart and the fracture surface examined for visual evidence of SCC. The as-received specimens were insensitive to SCC in these tests with the exception of one N-H117 specimen. All of the aged specimens of both alloys were susceptible to SCC. Author (GRA)

N74-21149# Lockheed Missiles and Space Co., Sunnyvale, Calif.
MATERIAL PROPERTIES STUDY. VOLUME 1: RESPONSE OF BERYLLIUM STRUCTURES TO IN-DEPTH HEATING BY ELECTRON BEAMS Final Report, Mar. 1972 - Oct. 1973
Philip G. Underwood and Audley O. Burford Jan. 1974 164 p refs
(Contract DNA001-72-C-0055; DNA Proj. NWED-AD-306)
(AD-774501; LMSC-B259017-Vol-1; DNA-3214F-1-Vol-1) Avail: NTIS CSCL 11/6

An electron beam thermo-structural response study has been conducted to improve understanding of the response of structural elements to instantaneous in-depth heating. Six experiments were performed using the DNA SNARK electron beam generator to provide active data for the critical conditions of heating which were selected during an extensive pretest analysis. Dynamic measurements of longitudinal strain, tip displacement, and rear surface velocity history were obtained from strain gages, a high speed camera and a laser interferometer, respectively. The study has demonstrated that current electron beam accelerators may be successfully employed as radiation sources in structural response experiments. An extensive correlation study was performed in which experimental responses were compared with analytical results from existing computer codes. (Modified author abstract) GRA

N74-21150# Dayton Univ. Research Inst., Ohio.
RESEARCH AND DEVELOPMENT OF RARE EARTH-TRANSITION METAL ALLOYS AS PERMANENT-MAGNET MATERIALS Technical Report, 1 Jan. - 30 Jun. 1973

Alden E. Ray and Karl J. Strnat Oct. 1973 128 p refs
(Contract F33615-70-C-1625; AF Proj. 7371)
(AD-774471; UDRI-TR-73-50; AFML-TR-73-276) Avail: NTIS CSCL 09/1

The significant accomplishments of investigations conducted over the past three years are summarized. Topics covered include: the metallurgy and magnetic properties of the rare earth-cobalt-iron alloys R2(Co(1-x)Fex)17 with R = Y, Ce, Pr, Nd, Sm and MM (Ce-rich mischmetal); the rare earth-cobalt binary phase diagrams Ce-Co, Pr-Co and Nd-Co; the sintering and magnetic properties of the mixed rare earth-cobalt alloys R(1-x)PrxCo5, R = Sm, Didymium and R(1-x)NdxCo5, R = Pr, Sm, Didymium. (Modified author abstract) GRA

N74-21151# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
DEVELOPMENT OF ENGINEERING DATA ON THICK-SECTION ELECTRON BEAM WELDED TITANIUM Final Report, Mar. 1971 - Jun. 1973
John G. Bjeletich Aug. 1973 199 p refs
(Contract F33615-71-C-1338; AF Proj. 7381)
(AD-774051; LMSC-D352462; AFML-TR-73-197) Avail: NTIS CSCL 11/6

The report provides a vital portion of the basic engineering data necessary for the design of reliable and efficient airframe structures involving electron-beam weldments in titanium alloys. Tensile, fracture toughness, and subcritical crack growth properties of both base metal and weldments have been obtained for 1- and 2-in. Ti-6Al-4V and 1-in. Beta III plate. Test temperatures ranged from -65F to 175F and the test environments included laboratory air, water, salt water and JP-4 jet fuel. The concept of stress intensity factors from linear elastic fracture mechanics is used to quantitatively assess the load carrying capacity and crack growth resistance of the test materials. Fracture toughness and tensile properties are tabulated while the fatigue crack propagation and stress corrosion cracking rates are presented in a graphic format. GRA

N74-21152# Stanford Univ., Calif. Dept. of Materials Science and Engineering.
HIGH TEMPERATURE TEXTURE STRENGTHENING IN ZINC
G. R. Edwards, T. R. McNelley, and O. D. Sherby Dec. 1973 8 p refs
(Contract N00014-67-A-0112-0021; NR Proj. 031-715)
(AD-774739) Avail: NTIS CSCL 11/6

The authors have investigated the compressive creep behavior of zinc over a wide range of temperatures and strain rates as part of an investigation of zinc-based particulate composites. The purpose of this note is to illustrate the large anisotropy in strength observed by the authors in the textured zinc sample and to compare the results with other high temperature creep data reported for polycrystalline zinc. The salient feature of the results was the following: for the entire range of testing, samples deformed by uniaxial loading parallel to the extrusion axis were consistently 1.5 to 2 times stronger than samples deformed by loads applied parallel to the extrusion axis. GRA

N74-21153# Pratt and Whitney Aircraft, East Hartford, Conn.
APPLICATION OF THE KRYPTON EXPOSURE TECHNIQUE (KET(R)) TO DETECTION OF DEFECTS ASSOCIATED WITH LOW CYCLE METAL FATIGUE Final Technical Report, 29 Jun. 1972 - 29 Jun. 1973
Frank Vicki Jan. 1974 59 p
(Contract N00019-72-C-0518)
(AD-774730; PWA-4822) Avail: NTIS CSCL 14/2

An engineering program was conducted to evaluate a krypton gas/exposure technique as a method of detecting minute defects on various metal surfaces. Such defects are associated with the early stages of low cycle metal fatigue. The program included: (1) preparation of test specimens from seven metal alloys presently used in aircraft weapon system hardware, (2) generation of defects on the surface of each specimen by cyclic bending, (3) detection of these defects by use of krypton gas and other non-destructive inspection techniques, and (4) comparative evaluation of the inspection results. These results indicated a significant potential for application of the krypton gas exposure technique, coupled with the need for further investigation to determine the source and solution of problems uncovered during this program. Author (GRA)

N74-21154# Virginia Univ., Charlottesville. Research Labs. for the Engineering Sciences.
SUPERPLASTIC DEFORMATION OF THE Zn-Al EUTECTOID AT CONSTANT STRAIN RATES
Glenn W. Franti, Roy H. Geiss, and H. G. F. Wilsdorf Dec. 1973 16 p refs
(Contract N00014-69-A-0060-0007)
(AD-773955; MS-3557-101-73; TR-1) Avail: NTIS CSCL 11/6

Tensile samples of three different grain sizes were prepared from the Zn-Al eutectoid and deformed at 250C at constant strain rates from .0004/min to .11/min in a modified Instron testing machine. Strain hardening was observed at low strain rates for the 0.5 and the 0.9 micrometer grain size samples and strain softening at the high strain rates. The 2.25 micrometer grain size samples showed strain softening at all strain rates. The microstructures of the strain hardened alloy showed dislocation activity in some aluminum-rich grains and rounding of the interphase boundaries. The samples deformed at the high strain rates showed little rounding of the boundaries and no dislocations. The 2.25 micrometer grain size samples showed considerable rounding of the boundaries at low strain rates and less evidence of this at the higher strain rates. Author (GRA)

N74-21155# General Electric Co., Schenectady, N.Y.
DEVELOP TECHNIQUES FOR THE PRODUCTION OF RADIALLY-ORIENTED COBALT-RARE-EARTH MAGNETS Final Technical Report, 1 Jul. 1972 - 30 Sep. 1973
Manfred Doser, Robert L. Horowitz, John R. Hughes, and Allan J. Kiesler Dec. 1973 74 p refs
(Contract F33615-72-C-1667; AF Proj. 7371)
(AD-774050; SRD-73-148; AFML-TR-73-289) Avail: NTIS CSCL 09/1

A number of critical applications exist for Co-rare-earth magnets which embody radial symmetry; hence, radial magnetization is of extreme importance. This work addresses the problem of producing Co5Sm shapes with radial orientation of the crystallographic c axis, or easy direction of magnetization, using processing techniques adaptable to manufacturing. Three processing techniques were investigated: (1) powder die pressing in which loose powders are magnetically oriented and pressed to form a ring, which is then sintered; (2) bending at elevated temperatures, wherein pressed and magnetically aligned slabs, lightly weighted, are heated near the sintering temperature and bent in fixtures to form radial arc segments; and (3) hot mechanical working to attempt to develop a crystallographic orientation and to produce a Co5Sm tube. (Modified author abstract) GRA

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N74-21156* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ULTRAVIOLET AND THERMALLY STABLE POLYMER COMPOSITIONS Patent
Ronald F. Reinisch, Hermilo R. Gloria, Ronald E. Goldsberry, and Michael J. Adamson, inventors (to NASA) Issued 9 Apr. 1974 8 p Filed 5 Jan. 1973 Supersedes N73-29554 (11 - 20, p 2435)
(NASA-Case-ARC-10592-1; US-Patent-3,803,090; US-Patent-Appl-SN-321179; US-Patent-Class-260.46.5E) Avail: US Patent Office CSCL 11D

A class of polymers is provided, namely, poly(diarylsiloxy) arylazines. These polymers have a basic chemical composition which has the property of stabilizing the optical and physical properties of the polymer against the degradative effect of ultraviolet light and high temperatures. This stabilization occurs at wavelengths including those shorter than found on the surface

of the earth and in the absence or presence of oxygen, making the polymers of the present invention useful for high performance coating applications in extraterrestrial space as well as similar applications in terrestrial service. The invention also provides aromatic azines which are useful in the preparation of polymers such as those of the present invention.

Official Gazette of the U.S. Patent Office

N74-21157 North Carolina State Univ., Raleigh.
MICROSTRUCTURAL FEATURES OF PLASTICALLY DEFORMED SPINEL-BASED CERAMIC-CERAMIC COMPOSITES Ph.D. Thesis
Curtis Edward Zimmer 1973 137 p
Avail: Univ. Microfilms Order No. 74-5506

Scanning and direct transmission electron microscopy and related instrumental techniques were employed to resolve microstructural details relating to (1) densification of $MgAl_2O_4$ by hot molding, (2) strengthening and reinforcement of the spinel matrix with up to 5 vol. % sapphire whiskers, (3) deformation processes occurring principally in the matrix during nondestructive bending to as much as 5% strain at 0.0005-0.01 in/min. displacement rates and temperatures ranging from 1250 to 1550 C, and (4) grain growth, pore development, whisker degradation, and other alterations occurring at the higher temperatures. The fabricating techniques employed yielded high densities of the whisker-matrix combination with strong intimate bonding of the whiskers to the matrix. The process was adequate for densification to near theoretical density at a temperature low enough to prevent (1) entrapment of porosity by rapid grain growth and (2) thermodynamic instability of the sapphire whiskers in the spinel matrix. Dissert. Abstr.

N74-21158*# Stanford Research Inst., Menlo Park, Calif.
LOX/GOX SENSITIVITY OF FLUOROELASTOMERS Final Report, 1 Jun. 1972 - 1 Oct. 1973
Norman Kirshen and Theodore Mill Sep. 1973 39 p refs
(Contract NAS8-28898; SRI Proj. PYU-1980)
(NASA-CR-120188) Avail: NTIS HC $5.00 CSCL 11D

The effect of formulation components and the addition of fire retardants on the impact sensitivity of Viton B fluoroelastomer in liquid oxygen was studied with the objective of developing a procedure for reliably reducing this sensitivity. Component evaluation, carried out on more than 40 combinations of components and cure cycles, showed that almost all the standard formulation agents, including carbon, MgO, Diak-3, and PbO_2, will sensitize the Viton stock either singly or in combinations, some combinations being much more sensitive than others. Cure and postcure treatments usually reduced the sensitivity of a given formulation, often dramatically, but no formulated Viton was as insensitive as the pure Viton B stock. Coating formulated Viton with a thin layer of pure Viton gave some indication of reduced sensitivity, but additional tests are needed. It is concluded that sensitivity in formulated Viton arises from a variety of sources, some physical and some chemical in origin. Elemental analyses for all the formulated Vitons are reported as are the results of a literature search on the subject of LOX impact sensitivity.

Author

N74-21159*# Furane Plastics, Inc., Los Angeles, Calif.
PRODUCTION DEVELOPMENT OF ORGANIC NONFLAMMABLE SPACECRAFT POTTING, ENCAPSULATING AND CONFORMAL COATING COMPOUNDS. VOLUME 1: DISCUSSION, FIGURES, AND REFERENCES
Sheldon L. Lieberman 31 Jan. 1974 181 p refs Original contains color illustrations 4 Vol.
(Contract NAS9-11068)
(NASA-CR-134234) Avail: NTIS HC $12.25 CSCL 11D

Based upon extensive contacts with vendors, a broad array of non-flammable polymeric specie, and additives generally noted to have flame retarding properties, were considered. The following polymeric matrices were examined: modified silicone and fluorosilicone RTV's polyesters, epoxies, urethanes, and epoxy-urethanes. Optimization of formulations to obtain a suitable balance between the various properties and flammability resistance led to the final selection of a silicone RTV/additive-loaded compound which meets almost all program requirements. The very low valued properties found are within a realistic level of design toleration. Complete formulation, processing, and test data is provided for this compound, EPOCAST 87517-A/B, and the other formulations prepared by the project. Details of those test methods are presented along with procedures utilized in the program. In addition, a description of the special flammability facility previously designed and then modified for this program is also presented. Author

N74-21160*# Furane Plastics, Inc., Los Angeles, Calif.
PRODUCTION DEVELOPMENT OF ORGANIC NONFLAMMABLE SPACECRAFT POTTING ENCAPSULATING AND CONFORMAL COATING COMPOUNDS. VOLUME 2: TABLES
Sheldon L. Lieberman 31 Jan. 1974 112 p 4 Vol.
(Contract NAS9-11068)
(NASA-CR-134235) Avail: NTIS HC $8.75 CSCL 11D

Tables are presented which include: material properties; elemental analysis; silicone RTV formulations; polyester systems and processing; epoxy preblends and processing; urethane materials and processing; epoxy-urethanes elemental analysis; flammability test results, and vacuum effects. K.M.M.

N74-21161*# Furane Plastics, Inc., Los Angeles, Calif.
PRODUCTION DEVELOPMENT OF ORGANIC NONFLAMMABLE SPACECRAFT POTTING, ENCAPSULATING AND CONFORMAL COATING COMPOUNDS. VOLUME 3: APPENDICES
Sheldon L. Lieberman 31 Jan. 1974 128 p ref 4 Vol.
(Contract NAS9-11068)
(NASA-CR-134236) Avail: NTIS HC $9.50 CSCL 11D

Appendices are presented which include: statement of work; material vendor contacts; formulation/processing data sheet; upward propagation test; flammability test conditions/results sheet; odor test; vacuum stability requirements; flammability test facility; determination of offgassing products and carbon monoxide test; and pneumatic and mechanical impact test guidelines. K.M.M.

N74-21162*# Furane Plastics, Inc., Los Angeles, Calif.
PRODUCTION DEVELOPMENT OF ORGANIC NONFLAMMABLE SPACECRAFT POTTING, ENCAPSULATING AND CONFORMAL COATING COMPOUNDS. VOLUME 4: EXECUTIVE SUMMARY
Sheldon L. Lieberman 31 Jan. 1974 13 p 4 Vol.
(Contract NAS9-11068)
(NASA-CR-134237) Avail: NTIS HC $4.00 CSCL 11D

The necessity of having nonflammable versions of potting and encapsulating compounds and conformal coatings for space vehicles is discussed. The formulation, EPOCAST 87517 A/B, was found to have the best balance of thermal, electrical, mechanical, physical, and chemical properties of those evaluated. The requirements which this formulation did not meet are listed, and other formulations which were evaluated are summarized. Recommendations for improving EPOCAST 87517 A/B are included. K.M.M.

N74-21163# Bureau of Mines, College Park, Md. Metallurgy Research Center.
RAPID GROWTH OF METALLIC FIBERS BY PARTITIONING SULFUR IN A COPPER-IRON-SULFIDE MINERAL
H. W. Leavenworth, Jr., B. W. Dunning, Jr., R. C. Gabler, Jr., and C. E. Goldsmith 1974 19 p refs
(BM-RI-7833) Avail: NTIS HC $4.00

A technique to grow metallic fibers from a sulfide mineral is discussed. Chalcopyrite ($CuFeS_2$) was made sulfur deficient, and the remaining sulfur partitioned to the iron in the mineral to liberate metallic copper, or to the copper to liberate metallic iron. The metals formed on the surface as fibers, and in the interior as spherical particles. Fiber growth was very fast. Lengths of 3 to 4 cm formed in a matter of minutes, and the diameter of individual fibers was less than 1 micrometer. The mechanism of fiber growth is explained, and the reactions are reversible as predicted. Copper fibers can be made to grow from the surface at 400 C or to dissolve back into the solid surface and be replaced by iron fibers at 625 C. Growth and dissolution can also be controlled to form copper/iron duplex fibers. Author

N74-21164# National Bureau of Standards, Washington, D.C. Inst. for Materials Research.

STANDARD X-RAY DIFFRACTION POWDER PATTERNS. SECTION 11: DATA FOR 70 SUBSTANCES
Howard E. Swanson, Howard F. McMurdie, Marlene C. Morris, Eloise H. Evans, Boris Paretzkin, Johan H. DeGroot, and Simon J. Carmel Feb. 1974 134 p refs
(NBS-Mono-25-Sect-11; LC-53-61386) Avail: SOD HC $1.55 as C13.44:25/Sec. 11

Standard X-ray diffraction patterns are presented for 70 substances. Fifty-two of these patterns represent experimental data and 18 are calculated. The experimental X-ray powder diffraction patterns were obtained with an X-ray diffractometer. All d-values were assigned Miller indices determined by comparison with computed interplanar spacings consistent with space group extinctions. The densities and lattice constants were calculated, and the refractive indices were measured whenever possible. The calculated X-ray powder diffraction patterns were computed from published crystal structure data. Both peak height and integrated intensities are reported for the calculated patterns. Author

N74-21165*# United Aircraft Corp., East Hartford, Conn. Research Labs.
ADDITIONAL DEVELOPMENT OF LARGE DIAMETER CARBON MONOFILAMENT Contractor Report, Jun. 1973 - Feb. 1974
B. A. Jacob and R. D. Veltri Feb. 1974 88 p refs
(Contract NAS3-16803)
(NASA-CR-134607) Avail: NTIS HC $7.50 CSCL 11D

The chemical vapor process for preparing a large diameter carbon-base monofilament from a BCl3, Ch4 and H2 gas mixture with a carbon substrate fiber was studied. The effect of reactor geometry, total gas flows and deposition temperature on the tensile strength of the monofilament were investigated. It was noted that consistent results could only be obtained when the carbon substrate fiber was cleaned. The strength of the monofilament was found to depend on the highest temperature and the temperature profile of the monofilament in the reactor. The strength of monofilament produced in the dc and RF reactors were found to be similar and similar alloy compositions in the monofilament were attained when the same gas ratios were used. The tensile strength of the monofilament at 500 C was found to be 60 to 70% of the room temperature tensile strength. No degradation was noted after exposure to molten aluminum. Author

N74-21166# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium).
DETERMINATION OF THE TECHNICAL CONSTANTS OF LAMINATES IN OBLIQUE DIRECTIONS. THEORY AND EXPERIMENTAL RESULTS [DETERMINATION DES CONSTANTES TECHNIQUES DES STRATIFIES DANS LES DIRECTIONS OBLIQUES. THEORIE ET RESULTATS EXPERIMENTAUX]
Fernand Vidouse Nov. 1973 42 p refs In FRENCH; ENGLISH summary Sponsored by Inst. pour l'Encour. de la Rech. Sci. dans l'Ind. et l'Agr.
(CRIF-PL-4) Avail: NTIS HC $5.25

An off axis tensile test theory based on Hookes law and applied to glass fiber reinforced laminates is presented. It aims at taking into account the anisotropy of the laminates. The theory introduces a corrective parameter dependent on the characteristics of the strain gage used in order to account for the parasitic moments introduced when using common testing machines set up for isotropic materials. Theoretical results were compared for a variety of strain gages with those obtained by a finite element method and with experimental results obtained on laminates reinforced with glass in various ways. ESRO

N74-21167# European Space Research and Technology Center, Noordwijk (Netherlands).
BLACK COATINGS TESTED AT ESTEC FOR SPACEFLIGHT USE
G. Schamle Paris ESRO Dec. 1973 16 p
(ESRO-TM-155-ESTEC) Avail: NTIS HC $4.00

The paint formulation, test results, and parameters of some black coatings, evaluated in the course of several ESRO satellite programs, which have shown good space stability, are described. ESRO

N74-21168# Magnesium Elektron Ltd., Swinton (England).
IMPREGNATION OF ANODIC FILMS FOR THE PROTECTION OF MAGNESIUM ALLOYS
J. F. King, K. G. Adamson, and W. Unsworth London Min. of Defence Feb. 1973 36 p ref
(Contract KS/1/0579/C.B.43(a)2)
(D-MAT-193; BR-38303) Avail: NTIS HC $5.00

The resin impregnation of Dow 17 and H.A.E. anodic films on magnesium alloys was investigated. A number of solvent free and solvent containing resins were evaluated using dip and vacuum impregnation techniques. It was possible to effectively impregnate anodic films with a number of resins using a simple dip technique, but epoxy resins gave the best corrosion protection. Evaluations carried out on simple panels showed that the impregnated anodic film was harder, more abrasion resistant, and less prone to creepage corrosion than the present recommended pretreatment of fluoride anodizing, stripping, chromating, and surface sealing. Corrosion tests were carried out on flange assemblies with various protective systems based on impregnated anodic coatings. An improvement in corrosion protection was observed; however, the improvement in protective value was not sufficient to permit a reduction in the standard of assembly and overpainting procedure for magnesium components. The elimination of galvanic contacts by wet assembly had an overriding effect on the protective value of any of the schemes examined. Author (ESRO)

N74-21169# Magnesium Elektron Ltd., Swinton (England).
EVALUATION OF HIGH TEMPERATURE-RESISTANT COATINGS FOR THE PROTECTION OF MAGNESIUM ALLOYS
K. G. Adamson, J. F. King, and W. Unsworth London Min. of Defence Jul. 1973 35 p
(D-MAT-196; BR-38312) Avail: NTIS HC $4.75

A number of commercially available high temperature resistant coatings on magnesium alloys were evaluated by subjecting them to temperatures up to 350 C for periods up to 1,000 hours, followed by exposure to corrosion tests. Only two prints showed any degree of temperature resistance at 350 C and none of the coatings maintained satisfactory corrosion protection after temperature exposure in excess of 100 hours at 200 C. The effect of surface pretreatment was examined for two coatings resulting in considerable improvement for the aluminum-silicone coating. Tests were also carried out to determine the effect of adding strontium chromate to the aluminum pigmented silicone resin coating. In general the chromate pigment raised the temperature resistance of the coating to over 1000 hours at 300 C on chrome-manganese pretreatment. ESRO

N74-21170# Institut fuer Festkoerpermechanik, Freiburg (West Germany).
MULTIPLE CRACKS IN LAYERED COMPOSITES [MEHRFACHRISSE IN GESCHICHTETEN VERBUNDWERKSTOFFEN]
M. Ratwani 1972 36 p refs In GERMAN; ENGLISH summary
(WB-6/72) Avail: NTIS HC $4.00

The plane strain and antiplane shear problems for layered composites and isotropic materials were considered. The interaction between parallel and collinear cracks was studied. Using integral transform technique, the problem was reduced to a solution of integral equations. The effects of crack size, layer thickness, and distance between cracks were also studied. Author (ESRO)

N74-21171# Princeton Univ., N.J. Dept. of Chemical Engineering.
LOW FREQUENCY THERMOMECHANICAL SPECTROMETRY OF POLYMERIC MATERIALS: COMPUTERIZED TORSIONAL BRAID EXPERIMENTS. 1: OVERVIEW. 2: DATA PROCESSING. 3: TACTIC POLYMETHYL METHACRYLATES Technical Report, Jan. 1973 - Jan. 1974
J. K. Gillham, S. J. Stadnicki, and Y. Hozony Jan. 1974 24 p
(Contract N00014-67-A-0151-0024; NR Proj. 356-504)
(AD-773944; TR-20) Avail: NTIS CSCL 11/9

The torsional braid experiment has been interfaced with a centralized Hierarchical Computing System for data acquisition and data processing. Such a system, when matched by the

appropriate upgrading of the monitoring techniques, provides high resolution thermomechanical spectra of rigidity and damping, and their derivatives with respect to temperature. Results for some polymethyl methacrylates are included. (Modified author abstract) GRA

N74-21172# Army Materials and Mechanics Research Center, Watertown, Mass.
SYNTHESIS AND BALLISTIC EVALUATION OF SELECTED TRANSPARENT POLYURETHANE BLOCK COPOLYMERS Final Report
Anthony F. Wilde, Richard W. Matton, Joseph M. Rogers, and Stanley E. Wentworth Dec. 1973 12 p
(DA Proj. 1T1-62105-A-329)
(AD-773689; AMMRC-TR-73-53) Avail: NTIS CSCL 19/4

A series of transparent polyurethane block copolymers has been synthesized in-house and cast into sheet specimens for ballistic evaluation. The ballistic performances were generally superior to polycarbonate and were found to increase with the following independent variations: higher cure temperature, longer room-temperature cure time, higher diisocyanate and diol content, and lower molecular weight (lower weight composition) of the polyether component. Concurrent high-speed photographs served to characterize the transient bowing of the polymer specimen, the velocities of plugs and fragments generated by the impact, and the FSP residual velocity. (Modified author abstract) GRA

N74-21173# Princeton Univ., N.J. Dept. of Chemical Engineering.
POLY (ETHYLENE CARBONATE) AND POLY (PROPYLENE CARBONATE): TRANSITIONS AND THERMOMECHANICAL SPECTRA Technical Report, Sep. - Dec. 1973
J. K. Gillham and K. Udipi Jan. 1974 12 p refs Submitted for publication
(Contract N00014-67-A-0151-0024; NR Proj. 356-504)
(AD-773934; TR-19) Avail: NTIS CSCL 11/9

The transitions and thermomechanical spectra (1 cps) of amorphous poly (ethylene carbonate), amorphous poly (propylene carbonate) and their 1/1 blend, as measured by torsional braid analysis, are reported. The blend is a two phase mixture rather than a solution. Influence of intra and inter molecular factors on the transitions is discussed. (Modified author abstract) GRA

N74-21174# Naval Research Lab., Washington, D.C.
PROPOSAL FOR THE INVESTIGATION OF THE EFFECTS OF STRESS ON POLARIZED FERROELECTRIC CERAMICS
Robert W. Timme 5 Feb. 1974 16 p refs
(AD-774693; NRL-MR-2731) Avail: NTIS CSCL 20/12

An investigation of the effects of multidimensional sustained stresses on polarized ferroelectric ceramics is proposed. The ceramics to be studied will be those lead zirconate titanate Types I, II, and III normally used in underwater sound transducers. Characterization of the ceramics is accomplished by measuring the elements of the piezoelectric constant tensors d and g and the dielectric constant tensor epsilon as a function of stress magnitude, dimensionality, and orientation. Author (GRA)

N74-21175# California Univ., San Diego. Dept. of Applied Mechanics and Engineering.
FINITE-AMPLITUDE ELASTIC-PLASTIC WAVE PROPAGATION IN LAMINATED COMPOSITES
G. A. Hegemier Jan. 1974 30 p refs
(Grants AF-AFOSR-1957-70; NSF GK-34017)
(AD-774657; AFOSR-74-0177TR; TR-14) Avail: NTIS CSCL 11/4

An approximate nonlinear theory is developed to describe finite-amplitude wave propagation parallel to the alternating layers of a laminated composite with elastic-plastic constituents. Model construction is based upon an asymptotic method in which dominant signal wavelengths are assumed large compared to typical composite microdimensions. The final equations evolve as a one-dimensional binary mixture theory. Author (GRA)

N74-21176# Drexel Univ., Philadelphia, Pa. Dept. of Metallurgical Engineering.
FORGING OF METAL-MATRIX COMPOSITES: AN EXPERIMENTAL AND ANALYTIC APPROACH TO PROCESS DESIGN
T. Erturk, H. A. Kuhn, and A. Lawley Jan. 1974 33 p refs
(Contract N00014-67-A-0406-0001; NR Proj. 031-721)
(AD-774757) Avail: NTIS CSCL 11/4

The large-scale plastic deformation behavior of aluminum-stainless steel fiber composites was examined under conditions of simulated forging. With the load applied perpendicular to the direction of reinforcement, deformation occurs in a plane strain mode with no metal flow in the direction of fiber alignment. Two possible types of material damage are identified: (1) void formation in the matrix adjacent to the fibers and inter-fiber cracking of the matrix; (2) breaking of the fibers, leading to deviations from plane strain deformation. Forming limit criteria for both types of damage were established in terms of the normal and lateral pressures in the material. These pressures are related to the workpiece geometry and friction parameters of the system through plasticity theory. Thus, the forming limit criteria, in conjunction with plasticity theory, form the basis of a rational approach to design of processes for forging complex shapes from fiber-reinforced composite materials having a ductile matrix. Author (GRA)

N74-21177# Naval Academy, Annapolis, Md. Div. of Engineering and Weapons.
WEDGE INDENTATION OF TWO PHASE MATERIALS
Edmund J. Sullivan, Jr. and Thomas W. Butler Dec. 1973 27 p refs
(AD-774105; EW-7-73) Avail: NTIS CSCL 11/4

A theoretical investigation has been made of the forces required to indent a type of ductile layered two phase material by a rigid smooth wedge. The semi-infinite material considered here has a central phase with contiguous regions on either side which have a yield strength either higher or lower than the central phase. Using plasticity limit theorems and simple compatible displacement fields, upper bound forces are obtained for symmetric indentation. Results for the entire range of indentation sizes have been determined. For the case when the outer regions have a higher yield strength than the central phase, the forces found as the indentation width approaches the spacing between the outer layers are lower than may have been anticipated. Author (GRA)

N74-21178# Southwest Research Inst., San Antonio, Tex.
HOT-WALL DEPOSITION TEST RESULTS ON THE EFFECT OF WEAR METAL Interim Report, 1 Aug. 1972 - 1 Nov. 1973
N. P. Cuellar and B. B. Baber 1 Feb. 1974 34 p refs
(Contract F33615-72-C-1097; AF Proj. 3048)
(AD-774589; SwRI-RS-609; AFAPL-TR-73-123) Avail: NTIS CSCL 11/8

A continuing investigation of the deposition characteristics of synthetic ester-base lubricants, as typified by Military Specifications MIL-L-7808 and MIL-L-23699, led to the discovery of the presence of appreciable metal (iron) content in the deposits recovered from the conventional bearing depositon tests and full-scale engine tests. Accordingly, a special test method was utilized to study the effect of wear metal generation on deposit ratings. The concentration of iron in the test lubricant and in the principal deposits was monitored by atomic absorption spectroscopy. A direct indication of the extent of wear metal generation was provided by weight loss measurements of spring-loaded mild steel wear plates mounted within the test-lubricant sump. Significant deposit rating increases were found in many instances, dependent upon the test lubricant and mangitude of wear. It is concluded that a knowledge of the inherent wear process is imperative in any definitive study of lubricant depositon. Author (GRA)

N74-21179# Artech Corp., Falls Church, Va.
FABRICATION AND TESTING OF SAPPHIRE-REINFORCED SUPERPLASTIC Ni-Cr-Fe ALLOY COMPOSITES Final Report, Apr. 1972 - Oct. 1973
Paul J. Lare, Fred Ordway, and Henry Hahn Nov. 1973 44 p refs
(Contract N00019-72-C-0439)
(AD-774065; J7120-FR) Avail: NTIS CSCL 11/4

Progress toward the fabrication of composites of Ni-Cr-Fe alloy reinforced with Al2O3 filaments is described. The sapphire filament material was found to vary in strength with the density

and distribution of microvoids. The fibers were laid up with sheets of the alloy that were grooved by a photochemical milling procedure to insure correct positioning. Consolidation of the composite by hot pressing with the matrix in the superplastic condition was demonstrated, but uniform complete consolidation was not achieved due to the limitations of the hot pressing equipment. Author (GRA)

N74-21180# Naval Civil Engineering Lab., Port Hueneme, Calif.
THERMAL CONDUCTIVITY MEASUREMENTS OF CRYOGENIC INSULATIONS AT HIGH PRESSURES
K. W. Tate and R. C. Westphal Jan. 1974 51 p refs
(AD-774470; NCEL-TN-1302) Avail: NTIS CSCL 13/10

A special test apparatus was developed to measure apparent thermal conductivity of powder insulations at cryogenic temperatures and high interstitial gas pressures. The test apparatus consisted of two concentric cylinders, with the test insulation contained in the annulus between the two cylinders. Thermal conductivity measurements were based on the radial heat flow from the outer cylinder to the inner cylinder. Tests were conducted at pressures from 14.7 to 5000 psia and a nominal temperature difference of 200 to 520R. Four common loose-fill, powder-type insulations were tested: vermiculite, diatomaceous earth, and two grades of perlite. Test results indicated that for all four insulations tested, apparent thermal conductivity was only weakly dependent on the interstitial gas pressure for pressures above 2000 psia. (Modified author abstract) GRA

N74-21181# Army Coating and Chemical Lab., Aberdeen Proving Ground, Md.
SUBSTITUTION OF TOLYLTRIAZOLE FOR MERCAPTOBENZOTHIAZOLE IN MILITARY COOLANT INHIBITOR FORMULATIONS Interim Report
Robert G. Jamison and Charles B. Jordan Jan. 1974 27 p refs
(DA Proj. 1T6-62611-A-109)
(AD-774293; CCL-3011) Avail: NTIS CSCL 11/7

The object of this study was to determine the feasibility of substituting tolyltriazole (TT) for mercaptobenzothiazole (MBT) in the corrosion inhibitor package used in military coolants. ASTM Glassware Corrosion Tests (D 1384) and Simulated Service Tests (D 2570) were conducted on various blends of antifreeze inhibitors with different percentages of sodium tolyltriazole (NaTT). The NaTT caused foaming in the tests, but a silicone type antifoam agent was found which controlled the foaming. Results of these tests were correlated with similar tests containing the amount of MBT recommended in coolant specifications (0.4% of the sodium salt). 0.15% was found to be the optimum percentage of NaTT. GRA

N74-21182# Watervliet Arsenal, N.Y.
ORGANIC MATRIX TOUGHENING ADDITIVES FOR COMPOSITE MATERIALS
Martin S. Ferguson Nov. 1973 34 p refs
(AD-774373; R-WT-T-6-43-73) Avail: NTIS CSCL 11/4

Toughening of organic matrix material has been shown feasible using precipitated rubber particles as the discontinuous phase in epoxy resins. Physical tests consisted of recording the work required (as a measure of thoughness) to separate a cantilevered cleavage specimen of epoxy matrix with and without these particles. Data is also presented from ASTM tensile tests to assess the extent of sacrifice in elastic modulus and ultimate tensile strength caused by the additions. Results are presented for three related epoxy resin systems and three hardeners while holding rubber additions at zero or ten ppH resin. Several resins used in filament winding or casting of composites show beneficial increases in toughness. Author (GRA)

N74-21183# Virginia Polytechnic Inst. and State Univ., Blacksburg.
TIME AND TEMPERATURE DEPENDENCE OF BORON EPOXY AND GRAPHITE-EPOXY LAMINATES Technical Report, 1 Jul. 72 - 30 Jun. 73
R. A. Heller, G. W. Swift, W. W. Stinchcomb, A. B. Thakker, and J. C. Liu 9 Nov. 1973 77 p refs
(Contract F33615-72-C-2111; AF PROJ. 7340)
(AD-774028; AFML-TR-73-261) Avail: NTIS CSCL 11/4

In order to develop techniques for accelerated characterization of composite materials, tests were performed on Boron/Epoxy and Graphite/Epoxy specimens. Results of vibration tests and constant strain rate tests at various temperatures are reported, together with some preliminary fatigue and damage studies. Author (GRA)

N74-21184# Solar, San Diego, Calif.
CERAMIC MATERIALS FOR GAS TURBINE ENVIRONMENT Final Report, 1 Apr. - 31 Dec. 1973
Mark J. Klein and Arthur G. Metcalfe Dec. 1973 47 p refs
(Contract DAAG46-73-C-0182; DA Proj. 1T0-62105-A-330)
(AD-774268; RDR-1774; AMMRC-CTR-73-52) Avail: NTIS CSCL 11/2

The effects of aluminum in silicon on the nitriding rate, structure and strength of the reaction sintered products were evaluated. Aluminum formed the stable nitride, AlN, when the powder compacts were first exposed to nitrogen, inhibiting the silicon-aluminum melt reaction. The high (negative) free energy of formation of AlN relative to Si_3N_4 appeared to be responsible for the early nitriding of aluminum. The reaction sintering kinetics were not materially affected by aluminum because of the initial formation of the stable aluminum nitride compound. The bend strength and the amount of alpha silicon nitride were, however, reduced by the aluminum additions. Conditions that favored melt formation before the aluminum was fixed as a nitride (high aluminum concentration and rapid heating) lead to segregation of the constituents and growth of porosity and silicon grains. The results confirm the importance of determining the effects of metal solutes in silicon on the properties of silicon nitride and on the technology of reaction sintering. Author (GRA)

N74-21185# Battelle Columbus Labs., Ohio.
INVESTIGATION OF TECHNIQUES TO NONDESTRUCTIVELY TEST REINFORCED PLASTIC COMPOSITE PIPE Interim Report, Sep. - Dec. 1973
M. J. Golis, R. P. Meister, J. L. Crowe, and G. J. Posakony 31 Dec. 1973 148 p Prepared in cooperation with Battelle-Northwest
(Contract DAAK02-74-C-0008; DA Proj. 1G7-62708-D-506)
(AD-774294) Avail: NTIS CSCL 13/11

The report discusses the fundamental principles of ten potential techniques of pipe inspection, fabrication, installation, and the results obtained during selected experiments designed to verify the performance characteristics of each respective method. The methods considered likely candidates for the inspection task included optical viewing, ultrasonics, radiometry and microwave monitoring. Other methods considered during the study included holography, acoustic emission, thermal inspection and radiography. The flaws considered most detrimental to RPC pipe were undercure, resin starved and/or resin rich areas, delaminations, unbonded inclusions and folds in the prepreg tape. (Modified author abstract) GRA

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

N74-21186 Texas Univ., Austin.
MODEL ERROR COMPENSATION TECHNIQUES FOR LINEAR FILTERING Ph.D. Thesis
Hamilton Hagar, Jr. 1973 246 p
Avail: Univ. Microfilms Order No. 74-5245

The Kalman filter algorithm is discussed in light to its divergent effect upon the estimation process. A number of optimal and suboptimal modifying techniques are described which attempt to prevent this divergence. Extensions are developed resulting in adaptive forms and an algorithm is derived for sequentially estimating the state noise covariance matrix. Performance of the techniques is illustrated by their application to: (1) the terminal phase of an earth orbit rendezvous mission; and (2) the heliocentric trajectory determination of a solar electric propulsion space vehicle. Numerical results indicate that the model error difficulties can be sufficiently countered, with particularly effective performance

being supplemented by the sequential state noise covariance estimator. Dissert. Abstr.

N74-21187 Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
DIFFERENTIAL GAME BARRIERS AND THEIR APPLICATION IN AIR-TO-AIR COMBAT Ph.D. Thesis
Urban H. D. Lynch 1973 250 p
Avail: Univ. Microfilms Order No. 74-1108

The mathematical theory of perfect information, zero-sum, differential games is used as an analytical tool to learn about the one-on-one, air-to-air combat problem and the problem parameters which have major effect on its outcome. Emphasis is on differential game Barrier theory and the application of the Barrier as an analytical tool for air-to-air combat analysis. Barrier sensitivity analysis of the models shows that given the opportunity to increase a fighter aircraft's air-to-air combat capability with either improved turning gs, weapons system, or thrust to weight ratio, increased thrust to weight ratio yeilds the greatest improvement in this capability. Barrier results of the models are designed into a workable computational technique to evaluate the air-to-air combat capability of a series of fighter aircraft. Dissert. Abstr.

N74-21188 State Univ. of New York, Buffalo.
EIGENVALUES AND EIGENFUNCTIONS OF THE HOMOGENEOUS HELMHOLTZ EQUATION WITH ARBITRARY SHAPED DOMAIN AND ARBITRARY BOUNDARY CONDITIONS Ph.D. Thesis
George Ro- Chi Tai 1973 96 p
Avail: Univ. Microfilms Order No. 74-4450

An integral equation technique is employed to obtain eigenvalues and eigenmodes of a homogeneous Helmhotz equation for a two dimensional or three-dimensional arbitrary closed region with arbitrary boundary conditions. To demonstrate the capability of the integral equation method, an analytic solution is given to the boundary value problem for circular and spherical regions with a Dirichiet boundary condition and a Neumann boundary condition. For a demonstration of the applicability to a nonseparable boundary, a right triangle is chosen as the boundary. Eigenvalues and eigenmodes for cases alpha = 45 deg, 50 deg, 60 deg are obtained where alpha is an enclosed angle. The result for alpha = 45 deg case agrees well with that obtained by separation of variables. The results in the alpha = 50 deg and 60 deg cases are consistent with those in the alpha = a4e45 deg case. Dissert. Abstr.

N74-21189*# Stanford Univ., Calif. Artificial Intelligence Lab.
RESEARCH IN MATHEMATICAL THEORY OF COMPUTATION Final Report
John McCarthy Nov. 1973 14 p refs
(Contract NSR-05-020-500)
(NASA-CR-137983) Avail: NTIS HC $4.00 CSCL 12A

Research progress in the following areas is reviewed: (1) new version of computer program LCF (logic for computable functions) including a facility to search for proofs automatically; (2) the description of the language PASCAL in terms of both LCF and in first order logic; (3) discussion of LISP semantics in LCF and attempt to prove the correctness of the London compilers in a formal way; (4) design of both special purpose and domain independent proving procedures specifically program correctness in mind; (5) design of languages for describing such proof procedures; and (6) the embedding of ideas in the first order checker. A.L.

N74-21190*# New Mexico State Univ., Las Cruces. Communication Research Group.
ADVANCED STUDY OF VIDEO SIGNAL PROCESSING IN LOW SIGNAL TO NOISE ENVIRONMENTS Final Report, Jun. 1972 - Aug. 1973
Frank Carden Dec. 1973 101 p refs
(Grant NGR-32-003-037)
(NASA-CR-136897) Avail: NTIS HC $8.25 CSCL 12A

Conventional analytical techniques used to determine and optimize phase-lock loop (PLL) characteristics are most often based on a model which is valid only if the intermediate frequency (IF) filter bandwidth is large compared to the PLL bandwidth and the phase error is small. An improved model (called the quasi-linear model) is developed which takes into account small IF filter bandwidths and nonlinear effects associated with large phase errors. By comparison of theoretical and experimental results it is demonstrated that the quasi-linear model accurately predicts PLL characteristics. This is true even for small IF filter bandwidths and large phase errors where the conventional model is invalid. The theoretical and experimental results are used to draw conclusions concerning threshold, multiplier output variance, phase error variance, output signal-to-noise ratio, and signal distortion. The relationship between these characteristics and IF filter bandwidth, modulating signal spectrum, and rms deviation is also determined. Author

N74-21191# Lockheed Missiles and Space Co., Palo Alto, Calif.
RING CODER UNIT FOR CODES WITH BASE GREATER THAN TWO
Iu. S. Sharin [1973] 4 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Priborostr. (Leningrad), no. 2, 1973 p 63-65
Avail: NTIS HC $4.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Methods of constructing ring coders for multiposition codes are analyzed. Author

N74-21192# Lockheed Missiles and Space Co., Palo Alto, Calif.
PULSED AND DIGITAL AUTOMATIC SYSTEMS
G. I. Vaniurikhin, A. N. Gerasimov, S. V. Luchko, and L. F. Porfirev [1973] 40 p Transl. into ENGLISH from the book "Osnovy Avtomaticheskogo Upravleniia" Voenizdat, Moscow, 1972 p 299-323
Avail: NTIS HC $5.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Pulse systems with a linear continuous element are examined. Topics discussed include: mathematical equations for the pulsed system theory; pulse system transfer functions; fundamental concepts; and stability and quality of pulse systems. F.O.S.

N74-21193# Centre National de la Recherche Scientifique, Toulouse (France). Lab. d'Automatique et d'Analyse des Systemes.
DEVELOPMENT OF PREDICTION AND NONLINEAR FILTERING ALGORITHMS IN VIEW OF REAL TIME CONTROL OF INDUSTRIAL PROCESSES Final Report [DEVELOPPEMENT D'ALGORITHMES DE PREDICTION ET DE FILTRAGE NON LINEAIRE EN VUE DE LA CONDUITE EN TEMPS REEL DE PROCESSUS INDUSTRIELS COMPTE-RENDU DE FIN DE CONTRAT]
15 Dec. 1973 17 p refs In FRENCH
(Contract DGRST-71-7-2665)
(LAAS-Publ-1078) Avail: NTIS HC $4.00

Algorithms for nonlinear predictive filtering are discussed with a view to representing nongaussian probability densities. Some suboptimal schemes introduce a modified Riccati equation for which a numerical analysis structure research tool was constructed. The problem of the functional dependence of estimators in regard to constituents of a space generated by observations is discussed in light of the existence of recursive parameters in the representation of probabilities densities. Approximations to these functions were studied by direct exploitation of the representation theorem of Bucy and use of Fourier coefficients of the probability density. An expansion of the nonlinear filter around an optimal solution was derived. ESRO

N74-21194# Ecole Polytechnique Federale de Lausanne (Switzerland). Centre de Recherches en Physique des Plasmas.
A POWERFUL METHOD TO COUNT EIGENVALUES IN A GIVEN INTERVAL
R. Gruber Dec. 1973 7 p ref Sponsored by Swiss Natl. Sci. Found.
(LRP-75/73) Avail: NTIS HC $4.00

For the eigenvalue problem A vector x = Lambda B vector x, where the band matrices A, B are symmetric and B positive definite, the number of eigenvalues in a given interval (Lambda sub 0, Lambda sub 1) are counted. The chosen method conserves the band form of the sparse matrices during all calculations. Author (ESRO)

N74-21195# Loughborough Univ. of Technology (England). Dept. of Mathematics.
ASYMPTOTIC DISTRIBUTION OF THE EMPIRICAL PROCESS WHEN PARAMETERS ARE ESTIMATED FROM CENSORED DATA, WITH APPLICATIONS TO TESTING FOR NORMALITY
A. N. Pettitt Oct. 1973 25 p refs
(MATHS-Res-30) Avail: NTIS HC $4.25

The asymptotic distribution of the empirical process is studied when parameters must be estimated from censored data. The results are applied to finding the asymptotic distribution of a Cramer-von Mises statistic modified to test for normality with censored data. The statistic is shown to be an infinite sum of weighted chi-squared random variables. Asymptotic percentage points of this statistic are obtained by finding the distribution of a finite sum of weighted chi-squared random variables with the same mean and variance for the particular case when testing for normality, with mean and variance unknown, with censored data. ESRO

N74-21196# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
APPLICATION OF KOENIG'S THEOREM TO MODEL REDUCTION
Y. Shamash Feb. 1972 8 p refs Sponsored in part by London Univ.
(Publ-72/1) Avail: NTIS HC $4.00

Koenig's theorem, and its generalization, for the convergence of the poles of Pade approximants, was used to determine the minimum magnitude real and complex conjugate roots of nth order polynomials. The method of Eisenberg was shown to be a special case of the theorem. Koenig's theorem can also be used when the roots of the polynomial are close together, in which case Eisenberg's method fails to give accurate approximations. This method of computing the minimum magnitude zeroes of a polynomial is very well suited to the problem of reducing the order of linear time invariant systems since, using Koenig's theorem and its generalization, the dominant poles of the system can be picked out in one operation. Author (ESRO)

N74-21197# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
AN AMPLITUDE CONSTRAINED MINIMUM VARIANCE CONTROLLER
G. C. Goodwin Feb. 1972 8 p refs
(Publ-72/3) Avail: NTIS HC $4.00

Saturation of the input transducer is a frequently occuring difficulty with minimum variance controllers. This saturation can lead to serious deterioration in performance. A minimum variance control law was derived for the case when the input amplitude is constrained. Author (ESRO)

N74-21198# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
AN A PRIORI ESTIMATE FOR THE INFORMATION MATRIX OF A SINGLE INPUT/SINGLE OUTPUT LINEAR SYSTEM
R. L. Payne Mar. 1972 8 p ref
(Publ-72/4) Avail: NTIS HC $4.00

It is shown that, given estimates of noise model and system model parameters of a linear system, it is possible to obtain an estimate of Fisher's information matrix in terms of the parameter estimates and an arbitrary input sequence. It is further shown that the estimated information matrix may be partitioned into two square submatrices corresponding to the system model and noise model respectively and two zero submatrices corresponding to coupling between system and noise models. The submatrix corresponding to the noise model is found to be independent of the input sequence. Author (ESRO)

N74-21199# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
OPTIMAL TEST SIGNAL DESIGN FOR LINEAR SISO SYSTEM INDENTIFICATION
G. C. Goodwin, J. C. Murdoch, and R. L. Payne Mar. 1972 14 p refs
(Publ-72/5) Avail: NTIS HC $4.00

A sufficient condition for consistent estimates of parameters in linear SISO system identification is that the input signal should be exciting. However, in practice the exact nature of the test signal has a direct bearing upon the identification accuracy. It is shown how a-priori knowledge of the approximate system and noise model parameters may be used to design a test signal which will minimize the variance of the parameter estimates. The design procedure is computationally efficient as full advantage is taken of the special structure of Linear SISO systems. The optimal test signals are shown to result in a significant reduction in the parameter variances. This is of considerable practical importance as either the experiment time may be reduced for the same model accuracy or for fixed experiment time a model of much higher accuracy may be obtained. Author (ESRO)

N74-21200# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
LINEAR SYSTEM REDUCTION USING PADE APPROXIMATION TO ALLOW RETENTION OF DOMINANT MODES
Y. Shamash Apr. 1972 19 p refs
(Publ-72/6) Avail: NTIS HC $4.00

The dominant poles are determined using Koenig's theorem for the convergence of poles of Pade approximants, and the reduced order transfer function is than chosen to approximate the full system transfer function in the Pade sense. The main advantages of this method over other similar methods (methods that retain the dominant eigenvalues of the system) are the facts that it is computationally very easy to use and that the reduced model satisfies a measure of goodness criterion. The reduced model, of order K, gives satisfactory transient response under the application of a polynomial input of up to (K-1) degree in time. The method is extended to the problem of reducing the order of a high order multivariable system described by its transfer function matrix. A procedure for applying the method to systems described in a state space form is outlined. Author (ESRO)

N74-21201# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
A NEW TECHNIQUE FOR ORDER REDUCTION OF LINEAR SYSTEM
S. C. Chuang 1972 11 p refs
(Publ-72/7) Avail: NTIS HC $4.00

An approximation technique which differs from the ordinary Pade approximation technique is presented for reducing the order of linear systems described by transfer functions. This technique ensures approximations to both the initial transient and the steady-state responses. The technique proposed can sometimes be used to provide a stable approximation when the continued fraction expansion gives an unstable model. Similar results for a transfer function matrix are presented. The new approximation technique should facilitate the computation of low-order models, especially for multivariable systems. A numerical example is given. Author (ESRO)

N74-21202# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
CONJUGATE GRADIENT-V-CONTRACTION MAPPING
J. C. Allwright Jun. 1973 16 p refs Revised
(Publ-72/12-Rev) Avail: NTIS HC $4.00

The solution of linear equations Cu(o) +b = 0 for u(o) is considered, with C a positive-definite and self-adjoint operator. Such equations arise when solving-quadratic optimization problems and when solving partial differential equations using finite-difference methods. A standard solution technique is to approximate C by an operator K which is easy to invert and then to construct an algorithm of the contraction-mapping type to use K(-1) iteratively to help solve the original equation. For each K, a little-known generalization of the usual conjugate-gradient algorithm, is shown to have advantages over the corresponding contraction-mapping alrogithm in that it has better convergence properties. In addition, it is not significantly more difficult to implement. If K is a good approximation to C, the resulting generalized conjugate-gradient algorithm is more effective than the usual conjugate-gradient algorithm. Author (ESRO)

N74-21203# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
A COMPLETE SET OF INDEPENDENT DECOUPLING INVARIANTS
A. Alonso-Concheiro 1973 9 p refs Sponsored in part by

Banco de Mex., Natl. Univ. of Mex., and Brit. Council
(Publ-73/13) Avail: NTIS HC $4.00

Linear time invariant, m-input, m-output decouplable systems are studied with regard to the decoupling problem. The effect on an integration decoupling feedback law upon the observability and controllability of the system is discussed with regard to observability preservation. A set of positive integers is shown to be a complete set of independent invariants under feedback and similarity transformations. A canonical form is given for elements of the class of decouplable systems which preserve observability under integrator decoupling feedback law. This class is completely determined by the set of positive integers. ESRO

N74-21204# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
ON THE EXISTENCE OF OPTIMAL POLICIES IN STOCHASTIC CONTROL
M. H. A. Davis Jun. 1972 13 p refs
(Publ-72/16) Avail: NTIS HC $4.00

Conditions are given for the existence of an optimal control policy for a system described by stochastic differential equations of a specified form. The control vector takes values in a metric space and is allowed to depend on the complete past. Control policy is to be chosen so as to minimize a given cost function and the solution to the original differential equation is defined by the Girsanov transformation technique. The result is that if the argument in the differential equation satisfies a set of conditions which is detailed, then an optimal policy exists so long as a specified Hamiltonian function achieves its absolute minimum at all times. ESRO

N74-21205# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
FREQUENCY DOMAIN APPROXIMATION TECHNIQUE FOR OPTIMAL CONTROL
S. C. Chuang 1972 7 p refs
(Publ-72/17) Avail: NTIS HC $4.00

Extensive study was made of the problem of optimizing a linear stationary control system with respect to a quadratic cost function in the frequency domain. The solution requires the spectral factorization of a positive definite matrix often known as spectral density matrix (SDM) which is often very tedious, particularly for multivariable control systems. An approximation technique of the Pade type can be applied to the SDM P to obtain a low order approximation so that the corresponding suboptimal control to the system can be obtained easily. An iterative algorithm, in the frequency domain, is also presented. Several useful features of the algorithm are described. A numerical example is given.
Author (ESRO)

N74-21206# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
APPROXIMATION OF LINEAR TIME-INVARIANT SYSTEMS
Y. Shamash May 1972 7 p refs
(Publ-72/18) Avail: NTIS HC $4.00

In the study of control system, it is often desirable to approximate a high order linear time invariant system by a system of lower order using a reduction procedure. A method of reduction is introduced which retains the dominant modes of the system in the reduced model. The method is based on the concept of Pade approximation about two (or more) points. Koenig's generalized theorem for the convergence of poles of Pade approximants is of great value in this method since it can be used to compute the number of dominant modes of the system and their location. Author (ESRO)

N74-21207# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
MARTINGALE THEORY AND APPLICATIONS TO STOCHASTIC PROBLEMS IN DYNAMICAL SYSTEMS
E. Wong Jun. 1972 15 p refs
(Publ-72/19) Avail: NTIS HC $4.00

Martingales, very special forms of stochastic processes, are shown to have extensive applications in control and communication problems. A powerful calculus of martingales is presented. This calculus, based primarily on Ito's stochastic integral and its generalizations, provides a systematic means for dealing with conditional expectations with respect to continuously changing information patterns. Author (ESRO)

N74-21208# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
THE EFFECT OF FEEDBACK ON LINEAR MULTIVARIABLE SYSTEMS
D. Q. Mayne Sep. 1972 8 p refs
(Rept-72/26) Avail: NTIS HC $4.00

Effective algebraic procedures are presented for performing operations on a matrix transfer function, the most important being the calculation of the effect of feedback. The procedures given avoid the needless increase, which occurs when standard formulae are applied, in the degrees of the various polynomials involved. Author (ESRO)

N74-21209# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
MINIMAL REALIZATION OF A DIFFERENTIAL SYSTEM
Y. Shamash Aug. 1972 15 p refs
(Publ-72/30) Avail: NTIS HC $4.00

There are many algorithms for deriving a state variable model for a system defined by a matrix transfer function. It is shown how these algorithms may be applied to the derivation of state variable models for systems defined by linear constant differential equations, without the use of polynomial computations.
Author (ESRO)

N74-21210# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
COMPARISON OF SEVERAL METHODS FOR LINEAR SISO SYSTEM IDENTIFICATION
B. R. Shearer 1972 5 p refs
(Publ-72/34) Avail: NTIS HC $4.00

Comparison studies on SISO linear system identification are presented using two examples and six different identification programs. The programs were implemented on PDP 9 and CDC 6400 computers. ESRO

N74-21211# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
CONSTRUCTION OF THE INVERSE OF LINEAR TIME-INVARIANT MULTIVARIABLE SYSTEMS
Y. Shamash Oct. 1973 16 p refs Revised
(Publ-72/35-Rev) Avail: NTIS HC $4.00

An algorithm for constructing the inverse of a multivariable finite dimensional and time invariant dynamical system is introduced. It is equally applicable to continuous or discrete time systems. Systems may be described in state space form, by a transfer function matrix or by a set of constant differential equations. The algorithm is conceptually very simple and computationally easy. It incorporates a very simple criterion, which is part of the inversion algorithm, for determining whether a system is invertible. A direct method for computing the transfer function of a system described in state space form is also given. Several illustrative examples are discussed. Author (ESRO)

N74-21212# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
A NECESSARY AND SUFFICIENT CONDITION FOR DECOUPLING BY OUTPUT FEEDBACK
M. J. Denham Nov. 1972 5 p ref
(Publ-72/37) Avail: NTIS HC $4.00

Decoupling by output feedback of linear time invariant multivariable systems is presented. The problem is approached by a geometrical method and a solution is implemented. In a specified case the condition is necessary and sufficient for any output feedback solution to exist. The form of the condition may lead to systematic procedures for determining output feedback decoupling controls. ESRO

N74-21213# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
PARAMETERIZATION AND IDENTIFICATION OF LINEAR MULTIVARIABLE SYSTEMS
D. Q. Mayne Jul. 1972 8 p refs
(Publ-72/40) Avail: NTIS HC $4.00

A method for parameterization and identification of linear

deterministic discrete time dynamic multivariable systems is presented. It is shown that for each rational proper transfer function, there exists an output structure characterized by a set of integers of sums equal to the degree of the transfer function (state dimension of minimal realization). In some cases, the conditions are specified for which a canonical form can be specified such that a unique minimal realization has this form. All arbitrariness in the realization algorithm is removed. ESRO

N74-21214# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
THE SEQUENTIAL RETURN DIFFERENCE METHOD FOR DESIGNING LINEAR MULTIVARIABLE SYSTEMS
D. Q. Mayne and S. C. Chuang Oct. 1972 7 p refs Presented at the Conf. on Computer Aided Control Systems Design, Cambridge, Engl., Apr. 1973 Sponsored in part by Sci. Res. Council
(Publ-72/41) Avail: NTIS HC $4.00

If stability and disturbance attention are the sole design requirements, the multivariable controller can be synthesised by means of sequence of single-loop designs using conventional techniques (Bode, Nyquist, Root-Locus). Simple modifications enable security against component failure and low interaction to be obtained. Author (ESRO)

N74-21215# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
FIRST ORDER, STRONG VARIATION ALGORITHMS FOR OPTIMAL CONTROL PROBLEMS WITH TERMINAL INEQUALITY CONSTRAINTS
E. Polak and D. Q. Mayne Dec. 1972 18 p refs Partly sponsored by Sci. Res. Council
(Publ-72/45) Avail: NTIS HC $4.00

Eight algorithms for solving optimal control problems with general constraints on the control and inequality of the terminal state are presented. These algorithm are of the differential dynamic programming type and bear a strong kinship to nonlinear programming algorithms of the feasible directions type.
Author (ESRO)

N74-21216# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
TWO RECENT RESULTS IN NONLINEAR FILTERING THEORY
J. M. C. Clark Sep. 1972 9 p refs
(Publ-72/48) Avail: NTIS HC $4.00

Two recent results are reported. The first is a new proof of a filtering representation theorem. The second is about finite-dimensional nonlinear filters for a class of processes, involving a rotation coordinate, that arise in estimation problems such as FM demodulation. Author (ESRO)

N74-21217# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
CONTINUED FRACTION METHODS FOR THE REDUCTION OF LINEAR TIME-INVARIANT SYSTEMS
Y. Shamash 1972 6 p refs
(Publ-72/49) Avail: NTIS HC $4.00

Continued fraction methods for the reduction of order of single input - single output systems are given. A Jordan-type continued fraction is used to derive reduced order models. The reduced models are equivalent to the reduced order models obtained from a Cauer-type continued fraction. Continued fraction expansions are used to derive reduced models, with a biased transient response, whose power series expansion about $s = 0$ agree with that of the original system up to the term of degree k-1 for some k function of l. The practical importance of this is that biased reduced order models can now be obtained by just using Chen and Shieh's algorithm twice - no new algorithm is needed. Author (ESRO)

N74-21218# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
A GEOMETRIC APPROACH TO THE DECOUPLING OF LINEAR MULTIVARIABLE SYSTEMS BY OUTPUT FEEDBACK
M. J. Denham 1972 11 p refs
(Publ-72/51) Avail: NTIS HC $4.00

The state feedback decoupling problem for a linear multivariable system was formulated in geometric terms. The case is considered when not all the states necessary to implement the state feedback solution are measurable. It is shown how a set of controllability subspaces can be constructed on an extended state space, which form a solution to the output (measurable) feedback decoupling problem. Author (ESRO)

N74-21219# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
STABILIZATION OF LINEAR MULTIVARIABLE SYSTEMS BY OUTPUT FEEDBACK
M. J. Denham 1972 4 p refs
(Publ-72/52) Avail: NTIS HC $4.00

An alternative proof is given for a recently established sufficient condition for the stabilization of a linear time-invariant system by output feedback. Author (ESRO)

N74-21220# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
A METHOD FOR LINEAR SYSTEMS ORDER REDUCTION
S. C. Chuang 1972 7 p refs
(Publ-72/53) Avail: NTIS HC $4.00

It is often necessary, for analysis and design purposes, to reduce the order of the transfer function of a complex system. Several methods available for reducing the order of a transfer function in the frequency domain are briefly described. A more general approximation technique is presented. This technique ensures good approximations to both the initial transient and steady-state responses. The method is a generalization of other methods using continued fraction expansions. The operation and some useful features of an interactive program to implement the method on a PDP-15 computer are described. A numerical example is given. Author (ESRO)

N74-21221# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
OPTIMAL CONTROL
J. H. Westcott Sep. 1972 12 p refs Presented at the IMA Conf. on Recent Math. Develop. in Control, Bath, Engl., 5-7 Sep. 1972
(Publ-72/54) Avail: NTIS HC $4.00

Recent developments in optimal control are reviewed. A statement of the problem is made and the constraint conditions as expressed by differential equations and weighting functions are described. The range of theoretical approaches is discussed with emphasis on linear dynamics, quadratic cost case, dynamic programming, and use of weighting functions. Improvement in the quality of numerical procedures and algorithms for problem solving, notably by better and more pliable convergence of iterative solution, is also discussed. Application of optimal control is also considered. ESRO

N74-21222*# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
LIE THEORY AND CONTROL SYSTEMS DEFINED ON SPHERES
R. W. Brockett (Harvard Univ., Cambridge, Mass.) 1972 14 p refs
(Grant NGR-22-007-172; Contract N00014-67-A-0298-0006) (NASA-CR-137437; Publ-72/55) Avail: NTIS HC $4.00 CSCL 12B

It is shown that in constructing a theory for the most elementary class of control problems defined on spheres, some results from the Lie theory play a natural role. To understand controllability, optimal control, and certain properties of stochastic equations, Lie theoretic ideas are needed. The framework considered here is the most natural departure from the usual linear system/vector space problems which have dominated control systems literature. For this reason results are compared with those previously available for the finite dimensional vector space case. Author (ESRO)

N74-21223# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
DESIGN AND CHARACTERIZATION OF OPTIMAL TEST SIGNALS FOR LINEAR SINGLE INPUT-SINGLE OUTPUT PARAMETER ESTIMATION

G. C. Goodwin and R. L. Payne Jan. 1973 8 p refs
(Publ-73/1) Avail: NTIS HC $4.00

The choice of test signal in an identification experiment has a significant bearing upon the achievable accuracy. For large record lengths, the optimal signal for linear single input-single output parameter estimation may be characterized by its spectral properties. This fact is shown to lead to a general test signal design algorithm. Realizations of optimal test signals can be obtained with either amplitude or energy constraints. The design method is applied to several examples and it is shown to lead to improved estimation accuracy. Author (ESRO)

N74-21224# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
DETECTION OF SIGNALS WITH POINT PROCESS OBSERVATION
M. H. A. Davis May 1973 22 p refs
(Publ-73/8) Avail: NTIS HC $4.25

The detection of a random signal when the signal determines the rate of a point process was studied. A likely ratio formula (analogous to the LR for signals in white noise) was derived involving the conditional expectations of the rate given by the observations. It is shown that every measure absolutely continuous with respect to Poisson measure, corresponds to a process with random rate. The basis for the demonstration is a theorem according to which all local martingales of the Poisson process have a stochastic integral representation. ESRO

N74-21225# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
NONLINEAR FILTERING WITH POINT PROCESS OBSERVATIONS
M. H. A. Davis Jun. 1973 6 p refs
(Publ-73/15) Avail: NTIS HC $4.00

The calculus of discontinuous martingales was applied to derive equations describing the evolution of the conditional mean of a process which modulates the rate of a point process. The presentation is nonrigorous in that mathematical details are often omitted in favor of a clear exposition of the main ideas. The underlying basis for proving the theorem is that all martingales on the sigma-fields generated by a Poisson process are stochastic integrals. ESRO

N74-21226# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
THE MAXIMUM PRINCIPLE
G. F. Bryant and D. Q. Mayne Jun. 1973 32 p refs
(Publ-73/16) Avail: NTIS HC $4.75

A relatively simple proof of the maximum principle is presented. The main objective was to obtain a proof, similar to that due to Halkin, but replacing the use of Brouwer's fixed point theorem by an easily proven contraction mapping theorem. The first use of Brouwer's fixed point theorem, in proving the convexity of the reachable set of the linearized system, is eliminated by a simple, constructive proof of Lyapunov's theorem (requiring a slightly more general class of admissible controls than the piecewise continuous class employed by Halkin). The second use, in proving the fundamental lemma, is eliminated by a more powerful Balayage result and the use of an additional property of the linearized model of the nonlinear system, permitting a contraction mapping theorem to be employed. Author (ESRO)

N74-21227# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
A BAYESIAN APPROACH TO EXPERIMENT DESIGN WITH APPLICATIONS TO LINEAR MULTIVARIABLE DYNAMIC SYSTEMS
R. L. Payne and G. C. Goodwin Jul. 1973 12 p refs Presented at the IMA Conf. on Computational Probl. in Statist., Colchester, Engl., 25-26 Jul. 1973
Avail: NTIS HC $4.00

The experiment design problem is formulated in a Bayesian framework. This approach is shown to resolve the conceptual difficulties inherent in alternative formulations. An application of the theory to linear multivariable dynamic systems is given and it is shown that significant reductions in the computational requirements are afforded by the model structure.
Author (ESRO)

N74-21228# Naval Postgraduate School, Monterey, Calif.
SECOND ORDER NECESSARY CONDITIONS FOR GENERAL PROBLEMS WITH STATE INEQUALITY CONSTRAINTS
I. Bert Russak Jun 1973 99 p refs
(AD-773438; NPS-53RU73062A) Avail: NTIS CSCL 12/1

The paper is a sequel to an article by the author, concerned with a certain canonical problem in optimal control involving constraints of the type (Psi sub alpha) (t,x) < or = 0 alpha = 1,...,m. In that article a set of second order conditions necessary for a solution arc was obtained. In the paper those results are extended to a general control problem involving the above type of constraints. Author (GRA)

N74-21229# Florida State Univ., Tallahassee. Dept. of Statistics.
CONFERENCE ON RELIABILITY AND BIOMETRY Final Scientific Report, 1 Feb. - 31 Dec. 1973
Frank Proschan Dec. 1973 14 p refs Conf. held at Tallahassee, Fla., 9-27 Jul. 1973
(Grant AF-AFOSR-2482-73; AF Proj. 9769)
(AD-773373; AFOSR-74-0060TR) Avail: NTIS CSCL 12/1

The research topics include classes of life distributions and their properties, stochastic processes, linear models, competing risks, prediction and estimation of system reliability, life testing, comparison of populations, ranking, selection, and affinity measurement. GRA

N74-21230*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
BASIC ELEMENTS OF POWER SPECTRAL ANALYSIS
Davis D. Sentman 16 Jan. 1974 63 p refs Supersedes U-of-Iowa-73-24
(Grant NGL-16-001-002; Contract N00014-68-A-0196-0003) (NASA-CR-137404; AD-773936; U-of-Iowa-74-5; U-of-Iowa-73-24) Avail: NTIS HC $6.25 CSCL 12/1

A short presentation is made on the basic elements of Power Spectral analysis with emphasis on the Blackman-Tukey method. Short discussions are included on the topics of pre-whitening, frequency and spectral windows, and statistical reliability. Examples are included whenever possible, and a FORTRAN subroutine for calculating a power spectrum is presented.
Author (GRA)

N74-21244 Joint Publications Research Service, Arlington, Va.
RATIO OF THE OPTIMAL AND POLYNOMIAL INTERPOLATIONS
D. M. Sonechkin *In its* Meteorol. and Hydrol., No. 1, 1974 (JPRS-61729) 11 Apr. 1974 p 58-63 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 1, 1974 p 43-46 (For availability see N74-21239 12-20)

N74-21245 Joint Publications Research Service, Arlington, Va.
COMPARISON OF TWO ALGORITHMS OF DISCRIMINANT ANALYSIS
A. V. Meshcherskaya and V. A. Shakhmeyster *In its* Meteorol. and Hydrol., No. 1, 1974 (JPRS-61729) 11 Apr. 1974 p 64-76 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 1, 1974 p 47-55 (For availability see N74-21239 12-20)

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N74-21231 Pennsylvania State Univ., University Park.
AN EXPERIMENT IN NUMERICAL WEATHER PREDICTION USING ISENTROPIC COORDINATES Ph.D. Thesis
David William Marczely 1973 173 p
Avail: Univ. Microfilms Order No. 74-4272

A numerical weather prediction model in which the information levels are sloping isentropic surfaces, rather than conventional isobaric surfaces is investigated. While operational models have at least six levels and are generally diabatic, for economy, the thesis model has only three levels and is isentropic. The equations

for the model are the Eulerian primitive equations, in finite-difference form, for a hydrostatic atmosphere. Actual observational data, are used as the initial input for the seventy-two hour prediction. While the domain of the prognosis is a 53 x 57 grid, covering the Northern Hemisphere of the earth, a detailed diagnostic study is performed only on the initial twenty-four hour forecast for a selected cyclonic system in which diabatic processes are considered of only minor importance. For comparison, a three-level isentropic model, using essentially isobaric information surfaces, is subjected to the same experiment.

Dissert. Abstr.

N74-21232 Colorado State Univ., Fort Collins.
A DETERMINISTIC-STOCHASTIC MODEL OF LONGTERM CLIMATIC CHANGES Ph.D. Thesis
William Quen Chin 1973 201 p
Avail: Univ. Microfilms Order No. 74-5410

A mathematical procedure for quantitative evaluation of long-term climatic changes as a deterministic-stochastic process is described. The procedure relies on two basic hypotheses: (1) that long-term climatic changes are reflected in the fluctuations of the oxygen-18 content measured in carbonate shells from deep-sea sediment cores and in the ice core from the Greenland ice sheet, and (2) that long-period variation in the distribution of incoming solar radiation at the top of the earth's atmosphere as derived from the Milankovich theory of orbital and axial motions of the earth is the basic process affecting long-term climatic changes. A definite cooling pattern over the next 100,000 years is indicated with perhaps large advances in mountian glaciers; but no ice sheet of continental dimensions is apparent for this period on the basis of the deterministic part of the model.

Dissert. Abstr.

N74-21233 California Univ., Los Angeles.
THE RESPONSE OF A TROPICAL ATMOSPHERE TO MIDDLE LATITUDE FORCING Ph.D. Thesis
Vivian Ruhlig Lamb 1973 163 p
Avail: Univ. Microfilms Order No. 74-3980

The tropical atmosphere is represented as a stratified, compressible fluid, without wind shear, in a latitudinally-bounded channel on an equatorial beta-plane. It is assumed that the north and south lateral boundaries supply a forcing that determines the period, zonal wave number and vertical structure of the meridional perturbation velocity, and that these in turn determine the response within the model tropics. Then, for each period and zonal wave number, the variation of the energy flux pattern with the vertical structure of the applied forcing is investigated to determine the vertical structure corresponding to a maximum in a measure of the concentration of upward energy flux about the equator. Comparison of these maximum for a wide spectrum of forcing demonstrates a definite selectivity in the responses the tropical atmosphere. It is found that these peak response of are closely related to the free modes of the model.

Dissert. Abstr.

N74-21234 Florida State Univ., Tallahassee.
A THREE DIMENSIONAL NUMERICAL MODEL OF THE LIFE CYCLE OF A HURRICANE Ph.D. Thesis
Rangarao Venkata Madala 1973 143 p
Avail: Univ. Microfilms Order No. 74-6724

A three layer numerical model is developed to simulate an asymmetric hurricane and to study the effect of a vertically shearing basic current on the growth of a vortex into a hurricane. The latent heat released in the cumulus clouds is parameterized in terms of hurricane scale variables. The sensible and latent heat transfer from the ocean surface to the boundary layer of the vorted was implicity included in the model. In order to predict over a large area a multi-grid network is used with a finest grid network of grid length 20 km near the center of the hurricane. This region is surrounded by two coarse grid networks with grid lengths of 60 km and 180 km. A semi-implicit time integration scheme, is used to reduce the amount of computing time necessary for integration.

Dissert. Abstr.

N74-21235*# Colorado State Univ., Fort Collins.
FEASIBILITY OF REMOTE EVAPORATION AND PRECIPITATION ESTIMATES
Willz Z. Sadeh Apr. 1974 32 p refs
(Contract NAS8-28590)
(NASA-CR-129023) Avail: NTIS HC $4.75 CSCL 04B

Remote sensing by means of stereo images obtained from flown cameras and scanners provides the potential to monitor the dynamics of pollutant mixing over large areas. Moreover, stereo technology may permit monitoring of pollutant concentration and mixing with sufficient detail to ascertain the structure of a polluted air mass. Consequently, stereo remote systems can be employed to supply data to set forth adequate regional standards on air quality. A method of remote sensing using stereo images is described. Preliminary results concerning the planar extent of a plume based on comparison with ground measurements by an alternate method, e.g., remote hot-wire anemometer technique, are supporting the feasibility of using stereo remote sensing systems.

Author

N74-21236*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
EXTREME ATMOSPHERE MODELS, 1973
Keith W. Jeske Feb. 1974 46 p refs
(NASA-TM-X-58112; JSC-08824) Avail: NTIS HC $3.25 CSCL 04B

The results of a study that used radiosonde soundings to select the extreme atmospheric conditions in the continental United States are presented.

Author

N74-21237*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
A METEOROLOGICAL REPORT FOR THE MT. HOPKINS OBSERVATORY: 1968-1971
Michael R. Pearlman, Donald Hogan, Kenneth Goodwin, and DeWayne Kurtenbach 20 Jul. 1972 59 p ref
(Contract NAS12-2129)
(NASA-CR-137414; SAO-Special-Rept-345) Avail: NTIS HC $6.00 CSCL 04B

This document is a compilation of the weather data collected at the Mt. Hopkins Observatory in southern Arizona from 1968 to 1971. It is the second meteorological report aimed at assisting scientists in the scheduling of experiments at the Observatory site.

Author

N74-21238# National Meteorological Center, Washington, D.C.
STATUS REPORT ON A SEMI-IMPLICIT VERSION OF THE SHUMAN-HOVERMALE MODEL
Kenneth Campana Mar. 1974 26 p refs
(NOAA-TM-NWS-NMC-54) Avail: NTIS HC $4.50 CSCL 04B

The numerical weather prediction model developed by Shuman and Hovermale was reformulated for semi-implicit integration. Early results of real data experimentation with the new model are presented. Orography, friction, and diabatic effects are not treated in this model. Successful forecasts were made to 48 hours that compare favorably with results from a parallel explicit integration.

Author

N74-21239# Joint Publications Research Service, Arlington, Va.
METEOROLOGY AND HYDROLOGY, NO. 1, 1974
11 Apr. 1974 212 p refs Transl. into ENGLISH of Meteorol. i Gidrol. (Moscow), no. 1, 1974 p 3-126
(JPRS-61729) Avail: NTIS HC $13.75

Articles are presented on microclimate, agricultural meteorology, weather forecasting, climate control, hydrological forecasting, the activities, and personnel of the Soviet Hydrometeorological Service. For individual titles, see N74-21240 through N74-21258.

N74-21240 Joint Publications Research Service, Arlington, Va.
WORLD WEATHER WATCH: ITS EFFECT ON ECONOMIC AND SOCIAL DEVELOPMENT
V. A. Bugayev *In its* Meteorol. and Hydrol., No. 1, 1974 (JPRS-61729) 11 Apr. 1974 p 1-16 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 1, 1974 p 3-13 (For availability see N74-21239 12-20)

The functions and historical developments of the World Weather Watch (WWW), and the national meteorological services are described along with the World Meteorological Organization. The WWW was established to provide any country with weather information and to issue warnings and forecasts for economic

purposes. Long-range forecasts, forecasts dissemination, and climatic variations are briefly discussed. F.O.S.

N74-21241 Joint Publications Research Service, Arlington, Va.
COMBINED INVESTIGATIONS OF PECULIARITIES OF THE METEOROLOGICAL REGIME OF A BIG CITY IN THE EXAMPLE OF ZAPOROZHYE (CENEX-72)
M. Ye. Berlyand, K. Ya. Kondratyev, O. B. Vasilyev, I. V. Vasilchenko, V. F. Zhvalev, I. M. Zrazhevskiy, and L. S. Ivlev *In its* Meteorol. and Hydrol., No. 1, 1974 (JPRS-61729) 11 Apr. 1974 p 17-30 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 1, 1974 p 14-23 (For availability see N74-21239 12-20)

The results of the combined expedition for the study of meteorological regimes and air pollution in Zaporozh'ye are discussed. They pertain to the characteristics of the forces and the degree of atmospheric pollution, the spatial distribution of the air temperature and wind velocity, the integral and spectral characteristics of the radiation fluxes according to the data from ground and aircraft observations. Author

N74-21242 Joint Publications Research Service, Arlington, Va.
FORECASTING THE MONTHLY BEHAVIOR OF THE PRESSURE BY A PHYSICAL-STATISTICAL METHOD
M. I. Yudin and R. P. Reininskaya *In its* Meteorol. and Hydrol., No. 1, 1974 (JPRS-61729) 11 Apr. 1974 p 31-47 refs Transl. into English from Meteorol. i Gidrol. (Moscow), no. 1, 1974 p 24-35 (For availability see N74-21239 12-20)

An objective procedure is discussed for forecasting the intramonthly behavior of the pressure based on using the natural orthogonal components of the pressure field with respect to time. The comprehensive estimates of the forecast compiled in March and April 1965-1970 indicate the prospectiveness of the proposed procedure. The result of this forecast can be used to analyze the evolution of the baric field and for a synoptic evaluation of the future weather conditions. Author

N74-21243 Joint Publications Research Service, Arlington, Va.
FACTORS DETERMINING THE DIURNAL BEHAVIOR OF CLEAR SKY TRANSPARENCY
K. S. Shifrin, G. L. Shubova, and L. F. Shifrina *In its* Meteorol. and Hydrol., No. 1, 1974 (JPRS-61729) 11 Apr. 1974 p 48-57 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 1, 1974 p 36-42 (For availability see N74-21239 12-20)

A study was made of two causes affecting the diurnal behavior of the clear sky transparency: the actual diurnal variation of the state of the atmosphere and the apparent variations of the transparency connected with the diurnal behavior of the sun altitude (the Forbs effect). Author

N74-21244 Joint Publications Research Service, Arlington, Va.
RATIO OF THE OPTIMAL AND POLYNOMIAL INTERPOLATIONS c19
D. M. Sonechkin *In its* Meteorol. and Hydrol., No. 1, 1974 (JPRS-61729) 11 Apr. 1974 p 58-63 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 1, 1974 p 43-46 (For availability see N74-21239 12-20)

By using the canonical correlation technique, it is demonstrated that under defined conditions polynomial interpolation by the form of the notation alone differs from optimal. The quasioptimal method of estimating the weights of the polynomial interpolation based on the discrepancy principle and not requiring knowledge of the statistical structure of the meteorological fields is indicated. The result obtained can be used for the development of practical schemes for spectral objective analysis of meteorological fields. Author

N74-21245 Joint Publications Research Service, Arlington, Va.
COMPARISON OF TWO ALGORITHMS OF DISCRIMINANT ANALYSIS c19
A. V. Meshcherskaya and V. A. Shakhmeyster *In its* Meteorol. and Hydrol., No. 1, 1974 (JPRS-61729) 11 Apr. 1974 p 64-76 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 1, 1974 p 47-55 (For availability see N74-21239 12-20)

The discriminant analysis schemes of Sebestian and Wilkes are applied to precipitation in the Ukraine and Moldavia. It is shown that under certain conditions, both algorithms give constantly accurate results. Author

N74-21246 Joint Publications Research Service, Arlington, Va.
THE REGIME OF THE PRESENT LEVEL OF THE CASPIAN SEA AND FORECASTING ITS FUTURE LEVELS c13
K. I. Smirnova *In its* Meteorol. and Hydrol., No. 1, 1974 (JPRS-61729) 11 Apr. 1974 p 77-86 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 1, 1974 p 56-62 (For availability see N74-21239 12-20)

The quantitative indexes of the seasonal variability of sea level and the variability over many years are presented. A brief discussion is presented of the procedure for compiling the forecast of the annual behavior of sea level under the conditions of regulated river runoff and superlong range forecasting of the level for 5 and 18 years. The results of the water balance calculations for the mean sea level are presented to the year 2000. Author

N74-21247 Joint Publications Research Service, Arlington, Va.
CALCULATION OF THE WAVE REGIME OF SHELF BODIES OF WATER IN THE EXAMPLE OF THE BLACK SEA c13
G. V. Rzheplinskiy and L. N. Nazaretskiy *In its* Meteorol. and Hydrol., No. 1, 1974 (JPRS-61729) 11 Apr. 1974 p 87-94 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 1, 1974 p 63-68 (For availability see N74-21239 12-20)

The procedure and the results of calculating the wave regime of the shelf water of the Black Sea are discussed. Analogous data with respect to the wave regime can be obtained for all shelf water of the inland seas of the U.S.S.R. Author

N74-21248 Joint Publications Research Service, Arlington, Va.
MODEL OF CALCULATION OF THE PERENNIAL FLUCTUATIONS OF THE SALT RESERVE AND MINERALIZATION OF LAKE BALKHASH c13
V. V. Golubtsov *In its* Meteorol. and Hydrol., No. 1, 1974 (JPRS-61729) 11 Apr. 1974 p 95-106 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 1, 1974 p 69-76 (For availability see N74-21239 12-20)

A study was made of the model reflecting the dynamics of the salt balance of Lake Balkhash. The methods of the theory of dynamics control systems were used when developing it. The model takes into account the separate occurrence of ionic runoff of the Ili River and the total ionic runoff of the Karatal, Lepsa, Aksu, and Ayaguz Rivers, the additional influx of salt from the irrigated fields and the salt exchange through the Uzun-Aral channel. The proposed scheme can be used to simulate the various design situations for the perennial fluctuations of the salt balance of the lake occurring when solving the Ili-Balkhash problem. Author

N74-21249 Joint Publications Research Service, Arlington, Va.
EFFECT OF AGROMETEOROLOGICAL CONDITIONS ON THE ESSENTIAL-OIL ROSE HARVEST
L. P. Savchuk *In its* Meteorol. and Hydrol., No. 1, 1974 (JPRS-61729) 11 Apr. 1974 p 107-115 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 1, 1974 p 77-81 (For availability see N74-21239 12-20)

The results of studying the effect of the amount of precipitation and the number of days with sukhoveys on the essential-oil rose harvest are presented. The described methods of processing the perennial data on the harvest of rose plantations of different maturity raised in different soil-climatic zones are recommended for analogous studies for other perennial crops. Author

N74-21250 Joint Publications Research Service, Arlington, Va.
STATISTICAL CHARACTERISTICS OF THE SPECTRA OF THE WIND VELOCITY PULSATIONS IN THE UPPER TROPOSPHERE AND LOWER STRATOSPHERE c13
N. Z. Pinus *In its* Meteorol. and Hydrol., No. 1, 1974 (JPRS-61729) 11 Apr. 1974 p 116-119 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 1, 1974 p 82-84 (For availability see N74-21239 12-20)

The wind velocity pulsations spectra are presented with 50, 80, and 95% cumulative recurrence rate for the region of wave numbers of 0.00002 to 0.001/m within the layers of the atmosphere of 7-10, 10-12, 12-18, and 7-18 km. Author

N74-21251 Joint Publications Research Service, Arlington, Va.
SOME RESULTS OF NUMERICAL SIMULATION OF

PROCESSES WHEN A PARTICLE SYSTEM FALLS IN A VISCOUS MEDIUM c12

S. L. Lebedev and O. N. Sabiyeva *In its* Meteorol. and Hydrol., No. 1, 1974 (JPRS-61729) 11 Apr. 1974 p 120-124 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 1, 1974 p 84-86 (For availability see N74-21239 12-20)

A study was made of the results of the numerical solution of the problem of a cloud of solid particles of identical size falling in a viscous liquid. The shape of the cloud, its density field, the velocity field of the liquid, and the falling rate of the cloud are described. Author

N74-21252 Joint Publications Research Service, Arlington, Va.
QUASIBIANNUAL CYCLICITY OF THE FORMATION OF STRATOSPHERIC ANTICYCLONES IN THE TROPICAL ZONE OF THE SOUTHERN PART OF THE PACIFIC OCEAN c13

N. I. Pavlov and V. Ya. Tkachenko *In its* Meteorol. and Hydrol., No. 1, 1974 (JPRS-61729) 11 Apr. 1974 p 125-131 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 1, 1974 p 86-89 (For availability see N74-21239 12-20)

In the analysis of the data obtained from the aerosynoptic observations on trips 1, 4 to 8 of the scientific research ship Akademik Korolev, during the period from 1968 to 1972, the quasibiannual cycle of the formation of stratospheric anticyclones was discovered in the tropical zone of the southern Pacific Ocean. Author

N74-21253 Joint Publications Research Service, Arlington, Va.
PRECIPITATION DISTRIBUTION IN THE UKRAINIAN CARPATHIANS FOR VARIOUS AIR FLOWS IN THE LOWER TROPOSPHERE

V. S. Antonov and I. I. Drukman *In its* Meteorol. and Hydrol., No. 1, 1974 (JPRS-61729) 11 Apr. 1974 p 132-138 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 1, 1974 p 89-92 (For availability see N74-21239 12-20)

On the basis of the statistical processing of the observation data for the precipitation at 24 hour stations and outposts located within the territory of the Ukrainian Carpathians, the Carpathian foothills, and the Trans Carpathia, demonstrated the distribution of the daily mean amount of precipitation in the above-indicated orographic region with perpendicular air flows in the layer from the ground to 3 km (southwesterly and northeasterly flows) and parallel flows in the same layer there (northwesterly and southeasterly flows). Author

N74-21254 Joint Publications Research Service, Arlington, Va.
EVALUATING THE IDENTITY OF METEOROLOGICAL MEASUREMENTS DRIFTING AND UNDERWAY ON A SHIP

N. A. Romanova *In its* Meteorol. and Hydrol., No. 1, 1974 (JPRS-61729) 11 Apr. 1974 p 139-145 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 1, 1974 p 92-95 (For availability see N74-21239 12-20)

On the basis of an analysis of the 7-months series of eight period standard meteorological observations in the test ground of the tropical Atlantic, a comparison was made between the meteorological measurements adrift and underway on a ship. It was established that the measurements of the air temperature, water temperature, absolute moisture, and clouds adrift and underway on a ship are identical within the limits of accuracy of the measurements. The evaluation of the measurements of the wind velocity with reliability close to one demonstrated that the divergences are of a systematic nature. An analysis was made of the differences obtained. Author

N74-21255 Joint Publications Research Service, Arlington, Va.
AGROMETEOROLOGICAL CONDITIONS OF WINTERING OF THE WINTER RYE IN THE TERRITORY OF THE UDMURT ASSR

V. N. Makalskaya *In its* Meteorol. and Hydrol., No. 1, 1974 (JPRS-61729) 11 Apr. 1974 p 146-152 refs Transl. into English from Meteorol. i Gidrol. (Moscow), no. 1, 1974 p 95-98 (For availability see N74-21239 12-20)

The results are discussed of the series of field experiments during three winters for studying the effect of sowing times, snow accumulation, and the preceding crops. The responses of the plants are established for different wintering conditions. An explanation is given to the phenomena of the plants perishing under the snow, and methods to conserve the plants are presented. Author

N74-21256 Joint Publications Research Service, Arlington, Va.
PROBLEM OF OPTIMAL UTILIZATION OF HYDROMETEOROLOGICAL INFORMATION WHEN MAKING ECONOMIC DECISIONS

B. N. Belyayev *In its* Meteorol. and Hydrol., No. 1, 1974 (JPRS-61729) 11 Apr. 1974 p 153-158 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 1, 1974 p 99-102 (For availability see N74-21239 12-20)

A study was made of certain aspects of the application of the methods of investigating operations for the solution to the problems of hydrometeorological servicing. Author

N74-21257 Joint Publications Research Service, Arlington, Va.
MODERN STATE OF THE ART IN MODIFYING CONVECTIVE CLOUDS TO CAUSE PRECIPITATION

V. P. Lominadze, I. T. Bartishvili, and B. Sh. Beritashvili *In its* Meteorol. and Hydrol., No. 1, 1974 (JPRS-61729) 11 Apr. 1974 p 159-172 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 1, 1974 p 103-110 (For availability see N74-21239 12-20)

A survey is made of the state of the art in modifying convective clouds artificially to produce additional precipitation. Author

N74-21258 Joint Publications Research Service, Arlington, Va.
FIFTEENTH ANNIVERSARY OF THE CONQUERING OF THE POLE OF RELATIVE INACCESSIBILITY c34

Ye. I. Tolstikov *In its* Meteorol. and Hydrol., No. 1, 1974 (JPRS-61729) 11 Apr. 1974 p 173-179 Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 1, 1974 p 111-114 (For availability see N74-21239 12-20)

The history of the creation of the Soviet Antarctic station at the Pole of Inaccessibility is discussed. Author

N74-21259# Joint Publications Research Service, Arlington, Va.
METEOROLOGY AND HYDROLOGY, NO. 12, 1973

1 Apr. 1974 189 p refs Transl. into ENGLISH of Meteorol. Gidrol. (Moscow), no. 12, 1973
(JPRS-61632) HC $12.50

Climatological, meteorological, and hydrological weather monitoring and forecasting methods are reported. For individual titles, see N74-21260 through N74-21274.

N74-21260 Joint Publications Research Service, Arlington, Va.
PROBLEMS OF TRAINING AND ADVANCED TRAINING OF PERSONNEL FOR THE USSR HYDROMETEOROLOGICAL SERVICE

K. A. Khzmalyan *In its* Meteorol. and Hydrol., No. 12, 1973 (JPRS-61632) 1 Apr. 1974 p 1-9 Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 12, 1973 p 3-9 (For availability see N74-21259 12-20)

The basic problems of improving the training of specialists for the hydrometeorological profile on different levels, and also advanced training of the workers of the U.S.S.R. hydrometeorological service in connection with its scientific and technical progress goals, are discussed. Author

N74-21261 Joint Publications Research Service, Arlington, Va.
ESTIMATING THE 5 AND 10 DAY MEAN TEMPERATURE FORECASTS

N. A. Bagrov and A. L. Kats *In its* Meteorol. and Hydrol. No. 12, 1973 (JPRS-61632) 1 Apr. 1974 p 10-21 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 12, 1973 p 10-18 (For availability see N74-21259 12-20)

The properties of some estimates of the quality of medium range forecasting used in practice are analyzed. In certain cases they all give unacceptable results. In order to eliminate these deficiencies, a new index is proposed for evaluating the forecasting quality equal to the ratio of the area with the forecasting error less than admissible (considering climatology) to the entire forecasting area. Author

N74-21262 Joint Publications Research Service, Arlington, Va.
DETERMINING THE WIDTH OF THE EQUATORIAL ZONE **c13**
Ye. M. Dobryshman *In its* Meteorol. and Hydrol., No. 12, 1973 (JPRS-61632) 1 Apr. 1974 p 22-28 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 12, 1973 p 19-23 (For availability see N74-21259 12-20)

Two versions of determining the width of the equatorial belt were considered. The first is based on analyzing the equations of dynamics of the earth's atmosphere; the second is based on comparing the amplitudes of the semiannual and annual course of the heat flux from the sun in the tropical zone. Both approaches gave the same value (5-7 degrees on each side of the equator).
Author

N74-21263 Joint Publications Research Service, Arlington, Va.
MODEL OF THE STANDARD RADIATION ATMOSPHERE (LONG-WAVE RADIATION) **c13**
N. A. Zaytseva, G. N. Kostyanoy, and V. I. Shlyakhov *In its* Meteorol. and Hydrol., No. 12, 1973 (JPRS-61632) 1 Apr. 1974 p 29-42 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 12, 1973 p 24-34 (For availability see N74-21259 12-20)

The basic components of the atmosphere affecting long wave radiation transport are discussed. Results are presented from analyzing the correlations of the radiation balance of the earth atmosphere system to the relative moisture of the air according to data from actinometric radiosounding of the atmosphere. A model is proposed for the standard actinometric atmosphere for long wave radiation.
Author

N74-21264 Joint Publications Research Service, Arlington, Va.
CONSTRUCTING THE BOUNDARY LAYER OF THE ATMOSPHERE ABOVE THE SURFACE WITH ARBITRARY ROUGHNESS CHARACTERISTICS **c13**
A. S. Gavrilov *In its* Meteorol. and Hydrol., No. 12, 1973 (JPRS-61632) 1 Apr. 1974 p 43-52 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 12, 1973 p 35-42 (For availability see N74-21259 12-20)

The hypothesis of the semiempirical theory of turbulence was used to study the planetary boundary layer of the atmosphere above a horizontal surface with randomly distributed obstacles characterized, on the average, by a set of parameters. A study was also made of the peculiarities of the turbulent flux inside the zone of the obstacles and in the entire boundary layer. A comparison was made with experimental data obtained both in wind tunnels and for direct measurements in the atmosphere above real rough surfaces.
Author

N74-21265 Joint Publications Research Service, Arlington, Va.
EXPERIMENTAL STUDIES OF THE COAGULATION OF CHARGED AND NEUTRAL DROPS OF COMPARABLE SIZES
N. V. Krasnogorskaya and A. I. Neizvestnyy *In its* Meteorol. and Hydrol., No. 12, 1973 (JPRS-61632) 1 Apr. 1974 p 53-65 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 12, 1973 p 43-52 (For availability see N74-21259 12-20)

The experimental device is described, and results are presented on studying the coagulation factor of charged drops with radii from 6 to 30 microns and charges from 1 x 10 to the minus 8th power to 5 x 0.00001 esu. The comparison of the results obtained with the existing theoretical studies is given.
Author

N74-21266 Joint Publications Research Service, Arlington, Va.
DETERMINATION OF AEROSOL AND MOISTURE TURBIDITY OF THE REAL ATMOSPHERE **c13**
M. S. Averkiyev and T. V. Yevnevich *In its* Meteorol. and Hydrol., No. 12, 1973 (JPRS-61632) 1 Apr. 1974 p 66-73 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 12, 1973 p 53-58 (For availability see N74-21259 12-20)

The absorption of radiation by water vapor was calculated by the formula of S. I. Sivkov. On the basis of these data and the values of the solar radiation of a dry but turbid atmosphere, when m = 2, the table of values of the intensity of the solar radiation in the real atmosphere was calculated. The graph of the isopleths was constructed which offers the possibility of finding the characteristics of the aerosol and moisture turbidity of the atmosphere.
Author

N74-21267 Joint Publications Research Service, Arlington, Va.
DEFINITION OF SOME UNIVERSAL RELATIONS IN THE BOUNDARY LAYER OF THE ATMOSPHERE **c13**
G. N. Solovyev *In its* Meteorol. and Hydrol., No. 12, 1973 (JPRS-61632) 1 Apr. 1974 p 74-81 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 12, 1973 p 59-64 (For availability see N74-21259 12-20)

The determination of the universal functions characterizing the friction and heat exchange between the underlying surface and the free atmosphere by experimental data is discussed.
Author

N74-21268 Joint Publications Research Service, Arlington, Va.
POSSIBILITY OF APPLYING THE ASCENDING INTENSITY FUNCTION DISTRIBUTION IN HYDROLOGIC CALCULATIONS
A. V. Rozhdestvenskiy and M. V. Zorin *In its* Meteorol. and Hydrol., No. 12, 1973 (JPRS-61632) 1 Apr. 1974 p 82-89 ref Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 12, 1973 p 65-71 (For availability see N74-21259 12-20)

The possibility of applying the ascending intensity function distribution in hydrology, and the limits of its practical use, are established.
Author

N74-21269 Joint Publications Research Service, Arlington, Va.
NEW VERSION OF THE METHOD OF AERIAL PHOTOGRAPHY OF SHADOWS TO STUDY THE SNOW COVER
Yu. D. Sharikov and V. G. Zdanovich *In its* Meteorol. and Hydrol., No. 12, 1973 (JPRS-61632) 1 Apr. 1974 p 90-95 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 12, 1973 p 72-76 (For availability see N74-21259 12-20)

A simple method of determining the thickness of the snow cover in the mountains using aerial photography of the shadows thrown by special stakes is proposed. The procedure does not require knowledge of the flight altitude, the angles of elevation, the latitude of the station or the observation time. The possibility of using the method to determine the water level in the reservoirs and streams is indicated.
Author

N74-21270 Joint Publications Research Service, Arlington, Va.
HYDRAULIC DRAG DURING FILTRATION OF WATER IN THE VEGETATIVE LAYER OF THE SOIL **c13**
A. D. Altshul and Nguyen Tay *In its* Meteorol. and Hydrol., No. 12, 1973 (JPRS-61632) p 96-105 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 12, 1973 p 77-84 (For availability see N74-21259 12-20)

As a result of applying the methods of filtration theory to the calculation of hydraulic drag in the vegetative layer of the soil, expressions were proposed for determining the generalized Reynolds number and the generalized hydraulic friction coefficient for flows in the vegetative layers taking into account the basic effective factors, including the flexibility of the stalks. On the basis of processing the results of laboratory experiments performed with a model artificial vegetation of two types, relations are recommended which relate the generalized hydraulic friction to the generalized Reynolds number for various flow regimes.
Author

N74-21271 Joint Publications Research Service, Arlington, Va.
FUNDAMENTALS OF THE METHOD OF AGROMETEOROLOGICAL FORECASTING OF THE MEAN OBLAST OAT HARVEST IN THE NONCHERNOZEM ZONE OF THE EUROPEAN TERRITORY OF THE USSR
A. N. Polevoy and T. I. Myzina *In its* Meteorol. and Hydrol., No. 12, 1973 (JPRS-61632) 1 Apr. 1974 p 106-116 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 12, 1973 p 85-92 (For availability see N74-21259 12-20)

The effect of agrometeorological conditions on the formation of the oat harvest was studied. The possibility of developing a method of agrometeorological forecasting of the mean oblast oat harvest in the nonchernozem zone of the European territory of the U.S.S.R. was investigated.
Author

N74-21272 Joint Publications Research Service, Arlington, Va.
EFFICIENCY OF THE HYDROMETEOROLOGICAL SERVIC-

ING OF THE NATIONAL ECONOMY c34
S. K. Cherkavskiy *In its* Meteorol. and Hydrol., No. 12, 1973 (JPRS-61632) 1 Apr. 1974 p 117-125 Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 12, 1973 p 93-97 (For availability see N74-21259 12-20)

The state of the art is discussed with respect to introducing the results of scientific research work, hydrometeorological information and forecasts into the practice of planning the utilization of natural resources, productive activity and construction planning and design; some of the scientific problems have been isolated, the resolution of which will permit an increase in efficiency of the hydrometeorological servicings of agriculture. Author

N74-21273 Joint Publications Research Service, Arlington, Va.
EXPERIMENT IN DETERMINING THE MOISTURE RESERVES IN THE SNOW COVER IN THE MOUNTAINS BY THE ABSORPTION OF GALACTIC COSMIC RADIATION c13
S. I. Avdyushin, Yu. F. Barabanshchikov, R. M. Kogan, Yu. M. Kulagin, I. M. Nazarov, Sh. D. Fridman, and I. S. Yudkevich *In its* Meteorol. and Hydrol., No. 12, 1973 (JPRS-61632) 1 Apr. 1974 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 12, 1973 p 98-102 (For availability see N74-21259 12-20)

The apparatus is described and the results are discussed from a prolonged experiment to determine the water reserves in the snow by recording galactic cosmic particle flux. It is demonstrated that with a moisture reserve range of 10-900 mm, the accuracy of measuring it by the absorption of the cosmic radiation is 34 mm. It is noted that the basic error in determining the moisture reserves arises from the diurnal variations of galactic cosmic radiation. A procedure is indicated for reducing this error. Author

N74-21274 Joint Publications Research Service, Arlington, Va.
MEASURING THE SEA WAVE PARAMETERS BY THE RADIOTECHNICAL METHOD FROM AN AIRCRAFT OR SPACECRAFT c13
A. A. Garnakeryan, K. L. Afanasyev, V. T. Lobach, and V. V. Timonov *In its* Meteorol. and Hydrol., No. 12, 1973 (JPRS-61632) 1 Apr. 1974 p 134-143 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 12, 1973 p 102-108 (For availability see N74-21259 12-20)

The heights of sea waves are determined from an aircraft or spacecraft by measuring the ratio of the incoherent component to the coherent component in the reflected radio-echo in the meter range of radio waves. It is experimentally demonstrated that it is possible to measure the length and direction of sea wave propagation by the spectral correlation characteristics of the echo. Author

N74-21275# National Weather Service, Silver Spring, Md.
THE NATIONAL WEATHER SERVICE AND WATER MANAGEMENT
1973 16 p
(NOAA/PA-71004) Avail: SOD HC $0.40 Domestic Postpaid or HC $0.30 GPO Bookstore

Weather forecasting services are discussed in terms of the hydrologic cycle, and water resources. The organization of the river and flood forecast services, and prediction techniques are described. F.O.S.

N74-21276# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE POSSIBILITY OF FORECASTING URBAN AIR POLLUTION BY THE METHOD OF PATTERN RECOGNITION
E. L. Genikhovich, V. A. Gushchin, and L. R. Sonkin [1973] 5 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 293, 1973 p 21-25
Avail: NTIS HC $4.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The statistical forecasting of air pollution was studied by using pattern recognition. The selection of predictors is discussed along with the difficulties in organizing the statistical forecast. F.O.S.

N74-21277# World Meteorological Organization, Geneva (Switzerland).
REPORT OF THE FIFTH SESSION OF THE TROPICAL EXPERIMENT BOARD Global Atmospheric Research Program
1974 62 p Conf. held at Geneva, 3-7 Dec. 1973 Prepared jointly with Intern. Council of Sci. Unions
(GARP-Spec-Rept-11) Avail: NTIS HC $6.25; WMO, Geneva

The conclusions of the fifth session of the Tropical Experiment Board for the Global Atmospheric Research program are presented. The five scientific subprograms of GATE are reviewed; approval was given for the broad outlines of various operational plans aimed at achieving the scientific objectives. Attention was also given to the problem of processing and archiving the large amount of data which will be produced. ESRO

N74-21278# World Meteorological Organization, Geneva (Switzerland).
THE CENTRAL PROGRAMME FOR THE GARP ATLANTIC TROPICAL EXPERIMENT
David D. Houghton Jan. 1974 44 p Prepared jointly with Intern. Council of Sci. Unions
(GATE-3) Avail: NTIS HC $5.25; WMO, Geneva

The central program for GATE which defines the scientific and observational priorities in GATE and forms a basis for the orderly development of the overall program and data management is described. In addition, the subdivisions of the total scientific program into subprograms are outlined and the relationship of each to the central program is considered. A summary of observational requirements according to platforms for the central program is also given. ESRO

N74-21279# World Meteorological Organization, Geneva (Switzerland).
THE BOUNDARY-LAYER SUBPROGRAMME FOR THE GARP ATLANTIC TROPICAL EXPERIMENT
Heinrich Hoeber, E. Augstein, N. L. Byzova, M. Dupuy, M. Garstang, H. Hinzpeter, J. Z. Holland, M. Miyake, Y. Ogura, R. J. Polavarapu et al Dec. 1973 137 p refs Prepared jointly with Intern. Council of Sci. Unions
(GATE-5) Avail: NTIS HC $10.00; WMO, Geneva

The need for boundary layer studies within GATE is briefly discussed and the scientific objectives of the boundary layer subprogram are defined. Experimental objectives are then outlined and the operational procedures necessary to achieve these objectives are described. Finally, the data sets to be provided by the experimenters and data handling specialists are defined, and the tasks to be performed by the various elements of the GATE data management plan are considered. ESRO

N74-21280# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON THE PROBLEM OF AN ANALYTICAL APPROXIMATION OF THE RESTRUCTURING OF THE DISTRIBUTION SPECTRUM OF DROPS OF CLOUDS WITH AN ACTIVE INFLUENCE ON THEM
V. N. Konashenok, V. G. Morachevskii, and V. V. Lyubchenko 11 Dec. 1973 10 p refs Transl. into ENGLISH from Probl. Fiz. Atmosfery (USSR), no. 4, 1966 p 143-147
(AD-773508; FTD-HT-23-305-74) Avail: NTIS CSCL 04/2

It is shown that the solution to the problem consists of: (1) the selection of values of the coagulation coefficient; (2) the introduction of constant values of supersaturation in the cloud, in which regard these supersaturations are not a property of the environment but are caused by the properties of the chemical composition of the drops; and (3) the introduction of a simplifying assumption of the preservation of the cloud environment in the course of the influence of an asymptotic simultaneous distribution spectrum. It is also shown that the restructuring of the spectrum of drops, as a result of the processes of condensation and coagulation in a cloud, involves finding the time dependence of the distribution function of drops by sizes. The equation for the distribution function is formulated and the solution of the restructuring problem is given. D.L.G.

N74-21281# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AUTOMATED OPERATIONAL PROCESSING OF METEOROLOGICAL INFORMATION AT THE HYDROMETEOROLOGICAL CENTER OF THE USSR

S. L. Belousov, Yu. I. Cherkasov, B. G. Buravtsev, and A. K. Artanova 7 Jan. 1974 23 p refs Transl. into ENGLISH from Tr. v Vsesoyuznogo Meteorol. Sezda, Sekts. Prognoza Pogody (USSR), v. 2, 1972 p 19-29
(AD-773298; FTD-MT-24-232-74) Avail: NTIS CSCL 04/2

The automated processing system is described and consists of the following stages: (1) the reception, primary processing, and storage of initial information; (2) the compiling of reports and the calculating of analyses and forecasts in accordance with the Regional Meteorological Center Program; and (3) the calculation of analyses and forecasts in accordance with the World-Wide Meteorological Center Program. D.L.G.

N74-21282# Allied Research Associates, Inc., Baltimore, Md.
DEVELOPMENT OF DIGITAL ENHANCEMENT TECHNIQUES APPLICABLE TO DIRECT READ-OUT (APT) METEOROLOGICAL SATELLITE IMAGES Final Report, Mar. 1972 - Jul. 1973
Ilan Tamches and Nathaniel J. Belknap Sep. 1973 130 p refs
(Contract N62306-72-C-0103)
(AD-774524; ARA-101F; EPRF-TR-3-73(ARA)) Avail: NTIS CSCL 04/2

Digital enhancement techniques applicable to Direct Readout (APT) Meteorological satellite images were developed, and computer routines designed and tested. Areas covered include melding of geographic grids with digital images; display of image arrays at mercator and polar stereographic projections; Fast Fourier Transform subroutine; digital filters for low frequency reduction, high frequency spatial enhancement, single frequency, and edge search and sharpen; and gray scale histograms. Author (GRA)

N74-21283# Naval Postgraduate School, Monterey, Calif.
A QUASI-EMPIRICAL MODEL OF THE HURRICANE BOUNDARY LAYER
Russell L. Elsberry, Nils A. S. Pearson, and Leino B. Corgnati, Jr. 31 Jan. 1974 34 p refs
(NR Proj. 083-275)
(AD-774512; NPS-51ES74011A) Avail: NTIS CSCL 04/2

Solutions have been obtained for the temperature and moisture distributions within the atmospheric boundary layer of an axisymmetric hurricane model. The intensity of the hurricane is related to the equivalent potential temperature gradient produced by a balance of heat sources and advection within the boundary layer. Solutions are obtained using the bulk aerodynamic transport equations or applying a two-layer, baroclinic boundary layer model by Cardone (1969). Equilibrium maximum wind speeds vary from minimal hurricane force to about 80 m/sec for fixed ocean temperatures between 27C and 31C. Observations of the oceanic heat loss in actual storms are necessary to establish the ratio of heat flux to momentum transfer in the high wind speeds treated by the model. Various applications of the model are proposed, with an ultimate goal of a time-dependent simulation of hurricane-ocean coupling.
Author (GRA)

N74-21284# Air Force Global Weather Central, Offutt AFB, Nebraska.
AFGWC MACRO-SCALE UPPER AIR ANALYSIS MODEL (REVISED) Final Technical Memorandum
Denis Moreno 1 Oct. 1973 28 p refs
(AD-774595; AFGWC-TM-73-1) Avail: NTIS CSCL 04/2

The AFGWC macro-scale numerical upper-air analysis program for the Northern and Southern Hemispheres is described. The program produces wind, D-value, and temperature analyses at 14 levels from 850 mb to 10 mb, and moisture analyses at four levels, 850 mb through 400 mb. A detailed explanation of the derivation of first guess fields is presented. The analysis technique is the method of successive corrections to a first guess field. Constraints are applied to the stability of each layer.
Author (GRA)

N74-21285# Environmental Prediction Research Facility (Navy), Monterey, Calif.
TROPICAL CYCLONE MOVEMENT FORECASTS BASED ON OBSERVATIONS FROM SATELLITES
Robert W. Fett and Samson Brand Jan. 1974 51 p refs
(AD-774683; ENVPREDRSCHF-Tech-Paper-1-74) Avail: NTIS CSCL 04/2

A method to predict 24-hr movement of tropical cyclones using consecutive daily satellite views is described. The method is based on the observation that changes in the location of major structural features of the storm are correlated with changes in the direction of movement of storm centers. Major structural features appear to retain the same relative location with respect to the direction of movement of the storm center. The rotation of features noted in comparing satellite views over a 24-hr period is frequently found to approximate in sense and value the further deflection the storm will take in its track during the following 24 hours. A test evaluation of the method by seven individuals using 31 separate data sets of satellite data produced results significantly better than official 24-hr forecasts.
Author (GRA)

N74-21286# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THEORETICAL INVESTIGATION OF PROCESSES OF NATURAL AND ARTIFICIAL CLOUD FORMATION
N. S. Shishkin, L. G. Kachurin, Yu. A. Dovgalyuk, D. D. Stalevich, and T. S. Uchevatkina 17 Jan. 1974 21 p refs Transl. into ENGLISH from Tr. Vses. Meterol. Sezda. Sekts. Aktivn. Vozdeistvii na Atm. Protsessy (USSR), v. 4, 1972 p 97-107
(FTD Proj. T74-01-20)
(AD-774412; FTD-MT-24-220-74) Avail: NTIS CSCL 04/2

It is pointed out that in the last two decades a substantial step forward has been made in the area of cloud physics. An initial system of equations for describing processes of cloud precipitation formation has been clearly formulated. In particular cases solutions of this equation have been obtained, a number of equations used earlier have been refined, and new working hypotheses have been put forward concerning the mechanism of formation of the spectrum of drops within clouds. GRA

N74-21287# Calspan Corp., Buffalo, N.Y. Interim Report, Jan. 1973
THE MICROSTRUCTURE OF RADIATION FOG AT TRAVIS AIR FORCE BASE
Eugene J. Mack and Roland J. Pilie Sep. 1973 76 p refs
(Contract F19628-72-C-0160; AF Proj. 8620)
(AD-774459; CALSPAN-CJ-5076-M-2; SR-2; AFCRL-TR-73-0609) Avail: NTIS CSCL 04/2

A field investigation of the microphysical and micrometeorological features of fog occurring near Travis AFB was conducted. Observations were obtained in 13 fogs which occurred on six evenings during January, 1973. The fogs which formed elsewhere and advected over the instrumented site ranged in depth from 10 to 100 m and persisted for periods ranging from 45 min to 5 hours. Observations of temperature, dew point, dew deposition, winds, vertical wind, net radiative flux, drop size and liquid water content are discussed in detail. Samples of fog water were also collected, and the chemical analyses of the fog water are discussed. Author (GRA)

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N74-21288 Stanford Univ., Calif.
DATA COMPRESSION IN RECURSIVE ESTIMATION WITH APPLICATION TO NAVIGATION SYSTEMS Ph.D. Thesis
Anil Narayan Joglekar 1973 149 p
Avail: Univ. Microfilms Order No. 74-6491

The measurement averaging technique is applied to two cases of aircraft navigation using two DMEs and either air data or inertial data. The results show that for the air data case for less than 40% covariance degradation, computation time may be reduced by a factor of 4; while for the inertial data case for less than 20% covariance degradation, computation time may be reduced by a factor of 10. The data compression technique is thus attractive for several cases of practical interests. Actual flight data are used to verify the analytical conclusions about

covariance degradation and the choice of sample interval.
Dissert. Abstr.

N74-21289*# Teledyne Systems Co., Northridge, Calif.
INVESTIGATION OF APPLICATION OF TWO-DEGREE-OF-FREEDOM DRY TUNED-GIMBAL GYROSCOPES TO STRAPDOWN NAVIGATION SYSTEMS Final Report
Apr. 1974 381 p refs
(Contract NAS1-12175)
(NASA-CR-132419) Avail: NTIS HC $22.25 CSCL 17G

The work is described which was accomplished during the investigation of the application of dry-tuned gimbal gyroscopes to strapdown navigation systems. A conventional strapdown configuration, employing analog electronics in conjunction with digital attitude and navigation computation, was examined using various levels of redundancy and both orthogonal and nonorthogonal sensor orientations. It is concluded that the cost and reliability performance constraints which had been established could not be met simultaneously with such a system. This conclusion led to the examination of an alternative system configuration which utilizes an essentially new strapdown system concept. This system employs all-digital signal processing in conjunction with the newly-developed large scale integration (LSI) electronic packaging techniques and a new two-degree-of-freedom dry tuned-gimbal instrument which is capable of providing both angular rate and acceleration information. Such a system is capable of exceeding the established performance goals. Author

N74-21290*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LANDING RATES FOR MIXED STOL AND CTOL TRAFFIC
John S. White Washington Apr. 1974 76 p refs
(NASA-TN-D-7666; A-5044) Avail: NTIS HC $4.00 CSCL 17G

A study was made to determine the expected landing rate for STOL-only traffic and mixed STOL-CTOL traffic. The conditions used vary from present day standards to an optimistic estimate of possible 1985 conditions. A computer program was used to determine the maximum landing rate for the specified conditions and aircraft mix. The results show that the addition of STOL on a CTOL runway increases the total landing rate if the STOL airborne spacing can be reduced by use of improved navigation equipment. Further, if both takeoff and landings are performed on the same runway, the addition of STOL traffic will allow an increase in the total operation rate, even with existing spacing requirements. Author

N74-21291# Prakla-Seismos G.m.b.H., Hannover (West Germany).
INTEGRATED NAVIGATION AND DATA ACQUISITION SYSTEM INDAS [INTEGRIERTES NAVIGATIONS - UND DATENERFASSUNGS-SYSTEM INDAS]
Friedhelm Sender, Heinrich Rehmert, and Joerg Kampmann Bonn Bundesmin. fuer Forsch. und Technol. Jan. 1974 88 p refs In GERMAN; ENGLISH summary
(BMFT-FBM-74-01) Avail: NTIS HC $7.50; ZLDI, Munich 18,50 DM

A high accuracy navigation system for use in the central Pacific was developed. The first project phase was the introduction of the transit Doppler sonar navigation system with an incorporated passive data logging facility. During the second phase, computer software was modified enabling the integration of worldwide available radio navigation system. In acceptance trails onboard the RV Valdivia, the transit Doppler sonar, radio navigation system was able to determine ship's position to within a few hundred meters. Author (ESRO)

N74-21292# Royal Aircraft Establishment, Farnborough (England).
A COMPARISON OF TWO METHODS OF CONSTRUCTING THE OPTIMAL TRANSFER FUNCTION FOR A SIMPLIFIED GUIDED-WEAPON SYSTEM
L. J. Richards and M. R. Abbott Jul. 1973 16 p refs
(RAE-TM-Math-7303; BR37523) Avail: NTIS HC $4.00

Two approaches to the simplified missile problem were considered, one approach uses a modification of the Wiener theory, the other uses a combination of modern filtering and control theory. It is shown that the two transfer functions that relate the acceleration to the measurement are identical. It is conjectured that the same result would be found if the two methods were compared on the full missile problem. ESRO

N74-21293# Ohio Univ., Athens. Dept. of Electrical Engineering.
IMPLEMENTATION OF A ONE-WAY RANGING, RANGE-RANGE NAVIGATION SYSTEM Semiannual Report, 10 Apr. - 10 Oct. 1973
Oct. 1973 25 p refs
(Contract DAAB07-71-C-0156)
(AD-773047; ECOM-0156-8; SAR-8) Avail: NTIS CSCL 17/7

A brief discussion of topics peripheral to the implementation of All-weather, Low-level Navigation by one-way ranging and rho-rho geometry is given. Of interest are digital phase measurement techniques, especially simplified versions using binary counting and processing. Improvements to a superheterodyne navigation receiver are suggested. The elimination of the on-board atomic (rubidium) clock is pursued through analysis of autocorrelation techniques, up-date of crystal clocks, and by other approaches involving an additional transmitter or more complex processing of signals. Author (GRA)

N74-21294# Naval Electronics Lab. Center, San Diego, Calif.
ACCURACY ESTIMATES FOR RELATIVE OMEGA
C. P. Kugel 10 Dec. 1973 37 p refs
(AD-773670; NELC-TD-297) Avail: NTIS CSCL 17/7

The document develops estimates for navigational fix accuracy to be expected when the signals of the Omega VLF Navigation System are used in the relative mode, under which circumstances the system is known as Relative Omega. Improved accuracy over that for standard Omega results because of the correlation of long-path signal phase variation as observed over a several-hundred-mile area. Results are developed from previous work on the expected accuracy of Differential Omega but modified to demonstrate the application to Relative Omega. Specifically, results are addressed to the use of AN/SRN-12 Omega receivers, as envisioned for a portion of the integrated navigation system to be used on DD 963-class Naval vessels. Effects of instrumentation, propagation, and geometry are considered. (Modified author abstract) GRA

N74-21295# Iowa State Univ. of Science and Technology, Ames. Engineering Research Inst.
PROJECT THEMIS: AUTOMATIC NAVIGATION AND CONTROL Final Report, Sep. 1967 - Aug. 1973
R. G. Brown Dec. 1973 27 p refs
(Contract N00014-68-A-0162; ERI Proj. 712-S)
(AD-773525; ISU-ERI-AMES-73281) Avail: NTIS CSCL 17/7

The report summarizes the technical accomplishments of the Themis Program on Automatic Navigation and Control at Iowa State University for the 1967-73 period. Brief statements describing major technical accomplishments are given as well as a complete list of technical reports, patents and journal papers. The future direction of the program is discussed, and a summary of the benefits derived by the Department of Defense and Iowa State University is presented. Author (GRA)

N74-21296# Mitre Corp., McLean, Va.
FEASIBILITY STUDY FOR AUTOMATING THE FAA CENTRAL ALTITUDE RESERVATION FACILITY Final Report
Gerald K. Mueller Dec. 1973 64 p
(Contract DOT-FA69NS-162)
(AD-774680; MTR-6416; FAA-EM-74-6) Avail: NTIS CSCL 01/2

The report documents a study of the Central Altitude Reservation Facility (CARF) of the Federal Aviation Administration. CARF has the responsibility for approving airspace reservations for missions that in general could not be accomplished without a reservation. The study was undertaken to determine whether the use of automation techniques could improve the efficiency and accuracy of the CARF operations in a cost effective manner, and to evaluate the impact of implementing CARF automation via the proposed Air Traffic Service Headquarters Computer.
Author (GRA)

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N74-21297 North Carolina State Univ., Raleigh.
THERMAL AND REACTOR ANALYSIS OF NUCLEAR ROCKET TRANSIENTS Ph.D. Thesis
Robert Rourke Mills, Jr. 7 May 1974 215 p
Avail: Univ. Microfilms Order No. 74-5498

The thermal and nucleonic behavior of a nuclear rocket during the startup transient was investigated. The fluid flow and heat transfer of the hydrogen coolant was thoroughly analyzed. It was found that the ideal gas law produced reasonably accurate results over the range of temperatures and pressures used in this study. A one-dimensional time-independent form of the three-dimensional time-dependent fluid flow equations was developed and shown to be suitable for calculations over a very wide range of fluid temperature and pressure. An expression for heat transfer in the fuel-moderator was derived which simplified time-dependent calculations of average fuel temperature distributions and wall temperature distributions. A three-group model of the reactor physics provided a good understanding of the neutronics of a NERVA reactor. Dissert. Abstr.

N74-21298# Technische Hogeschool, Delft (Netherlands). Afdeling der Werktuigbouwkunde.
ASPECTS OF TWO-PHASE GAS-LIQUID SEPARATION RELATED TO NUCLEAR STEAM SUPPLY SYSTEMS
C. A. Prins Jul. 1974 208 p refs
(WTHD-56) Avail: NTIS HC $13.50

Steam-water separation in nuclear boilers (Boiling Water Reactors and Pressurized Water Reactor steam generators) constitutes a technical and economical problem increasing with unit size, where compaction, a high efficiency and a low pressure loss are determining factors. The test loop, designed for steam-water gravity separation experiments under actual reactor conditions (70 and 50 bar), incorporates a riser (two diameters are used: 0.126 and 0.152 m), an annular downcomer and forced circulation, while the steam is raised outside the loop in a separate boiler. The principal experimental data obtained are quality and void fraction in the downcomer, measured for riser qualities in the range of 4 to 20% at superficial downcomer water velocities up to 0.5 m/s. The main purpose of the analytical part of the study is to formulate a two-dimensional mathematical model describing the behavior of two-phase mixtures in the vortex tube of the separator. Author

N74-21299# Power Reactor and Nuclear Fuel Development Corp., Tokai (Japan).
[PLUTONIUM FUEL RESEARCH, URANIUM ENRICHMENT TECHNOLOGY, AND JOYO REPROCESSING PLANT CONSTRUCTION] Semiannual Progress Report, Jul. - Dec. 1972
Apr. 1973 111 p refs
(PNCT-831-73-01) Avail: AEC Depository Libraries HC $7.75

Activities devoted to the development and fabrication of plutonium-bearing fuels, development of centrifugal uranium enrichment technology, construction of the Tokai Reprocessing Plant, and related research and development work are summarized. NSA

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics, 20 Meteorology; and 29 Space Radiation.

N74-21300* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
HIGH SPEED SHUTTER Patent
James O. McClenahan, inventor (to NASA) Issued 19 Mar. 1974 7 p Filed 30 Jun. 1972 Supersedes N72-27739 (10 - 18, p 2468)
(NASA-Case-ARC-10516-1; US-Patent-3,797,919; US-Patent-Appl-SN-267768; US-Patent-Class-350-270; US-Patent-Class-354-234) Avail: US Patent Office CSCL 20F

A shutter element is described which is formed by a loop of an electrically conductive ribbon disposed adjacent to the end of a passageway to be shuttered. The shuttered end of the passageway is cut at an acute angle. The two leg portions of the ribbon loop are closely spaced to each other and disposed in a plane parallel to the axis of the passageway. A pulse of high current is switched through the loop to cause the current flowing in opposite directions through adjacent leg portions of the ribbon. This produces a magnetically induced pressure on one of the legs of the ribbon forcing the leg over the end of the passageway in gas tight sealing engagement, and thereby blocking passageway. Official Gazette of the U.S. Patent Office

N74-21301 Texas Univ., Austin.
ELECTROMAGNETIC GENERATION OF ULTRASONIC SHEAR WAVES IN METALS Ph.D. Thesis
J. -P. Masson 1973 74 p refs
Avail: Univ. Microfilms Order No. 74-5283

A general theory for the electromagnetic generation of ultrasonic shear waves in metals with and without the presence of an external dc magnetic field and for frequencies going from the MHz to the GHz range has been developed. The model is characterized by the fact that it assumes a finite metallic slab and specular reflection of the electrons at the boundaries. It is valid for local and non-local regimes and the external excitation can be either an electromagnetic or an ultrasonic wave. The differential equations relevant to the problem are solved by expanding all quantities in Fourier series and the final results are obtained through numerical computations. A spherical Fermi surface is assumed in calculating the conductivity tensor. Dissert. Abstr.

N74-21302 Houston Univ., Tex.
EXPERIMENTS ON CAVITATION IN THE PRESENCE OF SECOND SOUND Ph.D. Thesis
Harish Chandra Dhingra 1973 86 p
Avail: Univ. Microfilms Order No. 74-2883

Cavitation in liquid helium was induced using a cylindrical transducer resonant at approximately 57 kHz. Interaction of the sound field with superfluid helium during cavitation runs was studied using a low power second sound signal. The signal was observed to decay when a voltage whose amplitude increased linearly with time was applied to the ultrasonic transducer. This is interpreted to be due to the growth of turbulence in the liquid. It is contended that for the sound field to induce cavitation the liquid has to be in a state of turbulence. It is possible that there is a threshold for additional attenuation of second sound signal near the onset of cavitation. In other experiments a higher second sound transmitter drive was used, under circumstances in which either the steady heat current or the second sound generates turbulence. The cavitation threshold was then lowered. Dissert. Abstr.

N74-21303 Carnegie-Mellon Univ., Pittsburgh, Pa.
THE APPLICATION OF NEW TRANSFER FUNCTIONS IN COHERENT OPTICAL DATA PROCESSING Ph.D. Thesis
Donald Paul Jablonowski 1973 210 p
Avail: Univ. Microfilms Order No. 74-4720

Transfer functions that may be implemented with relatively simple spatial filters are described. Specifically, these transfer functions employ composite grating spatial filters and a coherent optical feedback system. The application of composite gratings to image restoration of degraded photographic transparencies and to single step detection of degraded images was also studied. A mathematical description is presented of some of the more common degradations and methods for synthesizing the proper composite grating spatial filters. It is experimentally demonstrated that the grating filters are capable of replacing conventional inverse filters for some restoration operations. The simplicity of the grating filter permits the fabrication of combination filters to

perform two operations (restoration and detection) in a single step. Dissert. Abstr.

N74-21304* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
METHOD AND APPARATUS FOR OPTICALLY MONITORING THE ANGULAR POSITION OF A ROTATING MIRROR Patent
Jack C. Lansing, Jr. (Hughes Aircraft Corp., Los Angeles) and Richard W. Cline, inventors (to NASA) (Hughes Aircraft Corp., Los Angeles) Issued 9 Apr. 1974 6 p Filed 6 Jun. 1972 Supersedes N72-27736 (10 - 18, p 2468) Sponsored by NASA
(NASA-Case-GSC-11353-1; US-Patent-3,802,779; US-Patent-Appl-SN-260241; US-Patent-Class-356-152; US-Patent-Class-250-231SE; US-Patent-Class-350-299) Avail: US Patent Office CSCL 20F

An optical system monitors the angular position of a rotating scanning mirror to indicate the effective start and end of each scan. At a certain angular position, a ray of energy transmitted to the mirror is reflected a plurality of times between the reflectors associated with the optical system and the line on the mirror parallel to the axis, and then to a detector to sense that angular position. A single optical system may be arranged to sense a plurality of different angular positions for each revolution of the mirror. Official Gazette of the U.S. Patent Office

N74-21305 Northwestern Univ., Evanston, Ill.
OPTICAL WAVE PROPAGATION IN RANDOM MEDIA Ph.D. Thesis
Chester Stone Gardner 1973 216 p
Avail: Univ. Microfilms Order No. 74-7743

A treatment of optical wave propagation in random media using perturbation theory is reported. Monochromatic plane, spherical and beam wave propagation, pulsed wave propagation, propagation through slowly varying turbulent layers, and plane wave polarization fluctuations were considered. In all cases, either Born's or Rytov's perturbation technique was applied to the time dependent wave equation to obtain expressions for the turbulence induced log-amplitude and phase fluctuations. These expressions were then used to calculate various spatial, temporal, and frequency covariance functions. Exact solutions for the response due to a plane wave in a random medium with stationary temporal fluctuations was derived using the first order Born series perturbation term. The statistics for the log-amplitude, phase and polarization fluctuations were calculated and used to study the interaction of the propagating waves with the temporal fluctuations of the medium. Angular covariance functions for plane waves propagating in different directions were obtained. Dissert. Abstr.

N74-21306 Texas Univ., Austin.
PROPAGATION OF PLANE ACOUSTIC NOISE OF FINITE AMPLITUDE Ph.D. Thesis
Frederick Michael Pestorius 1973 237 p
Avail: Univ. Microfilms Order No. 74-5311

The propagation of plane finite amplitude noise waves in air was investigated. The reported research is both theoretical and experimental, and the results obtained are valid both before and after shock formation. In the theoretical portion, a model called modified weak shock theory is discussed. In this model the effects of ordinary weak shock theory and Kirchhoff tube wall attenuation and dispersion are combined. The inclusion of tube wall effects is necessary because the experimental work is done in a pipe. The modified weak shock theory is implemented in a computer algorithm. The theoretical model is applicable both before and after shock formation, it contains the effects of nonlinear distortion as well as tube wall attenuation and dispersion, and it is applicable for input waveforms of arbitrary shape. Previous theories do not include all of these features. Dissert. Abstr.

N74-21307*# California Univ., San Diego. Dept. of Applied Physics and Information Science.
APPLICATION OF SIGNAL DETECTION THEORY TO OPTICS Final Report
Carl W. Helstrom [1973] 34 p refs
(Grant NGL-05-009-079)
(NASA-CR-138984) Avail: NTIS HC $5.75 CSCL 20F

Basic quantum detection and estimation theory, applications to optics, photon counting, and filtering theory are studied. Recent work on the restoration of degraded optical images received at photoelectrically emissive surfaces is also reported, the data used by the method are the numbers of electrons ejected from various parts of the surface. Author

N74-21308*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECTS OF A TRAFFIC NOISE BACKGROUND ON JUDGEMENTS OF AIRCRAFT NOISE
Clemans A. Powell (Southampton Univ.) and C. G. Rice 21 Mar. 1974 15 p refs Presented at 87th Meeting of the Acoustical Soc. of Am., New York, 23-26 Apr. 1974
(NASA-TM-X-71938) Avail: NTIS HC $4.00 CSCL 20A

A study was conducted in which subjects judged aircraft noises in the presence of road traffic background noise. Two different techniques for presenting the background noises were evaluated. For one technique, the background noise was continuous over the whole of a test session. For the other, the background noise was changed with each aircraft noise. A range of aircraft noise levels and traffic noise levels were presented to simulate typical indoor levels. Author

N74-21309*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TRANSPORT PROPERTIES OF N2 GAS AT CRYOGENIC TEMPERATURES
Walter E. Pearson Washington Apr. 1974 14 p refs
(NASA-TN-D-7565; A-5327) Avail: NTIS HC $3.00 CSCL 20L

The viscosity and thermal conductivity of nitrogen gas for the temperature range 5 K - 135 K have been computed from the second Chapman-Enskog approximation. Quantum effects, which become appreciable at the lower temperatures, are included by utilizing collision integrals based on quantum theory. A Lennard-Jones (12-6) potential was assumed. The computations yield viscosities about 20 percent lower than those predicted for the high end of this temperature range by the method of corresponding states, but the agreement is excellent when the computed values are compared with existing experimental data. Author

N74-21310# National Bureau of Standards, Washington, D.C.
STANDARD REFERENCE MATERIALS: STANDARD QUARTZ CUVETTES FOR HIGH ACCURACY SPECTROPHOTOMETRY
R. Mavrodineanu and J. W. Lazar Dec. 1973 28 p refs
(NBS-SP-260-32; LC-73-600200) Avail: SOD HC $0.55 as C13.10:260-32 CSCL 20F

A description is given of the design and techniques developed for the production of quartz cuvettes having a nominal radiation pathlength of 10 mm + or - 0.03 mm. For each cuvette the pathlength and parallelism are certified with an uncertainty of + or - 0.0005 mm. The method and instrumentation used to determine these parameters is also described. Author

N74-21311# Lockheed Missiles and Space Co., Palo Alto, Calif.
ANALYSIS OF THE INTERACTION OF A SINGLE-STAGE CRYOGENIC EXPANDER SYSTEM WITH THE AMBIENT MEDIUM AND THE COOLING OBJECT
V. N. Novotelnov 1974 5 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Mashinostr. (Moscow), no. 1, 1974 p 97-102
Avail: NTIS HC $4.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The operation of a cryogenic system in the variable regime is analyzed. The system is represented by a linear mathematical model. Some effects of selecting fundamental parameters in the design mode on the external system characteristics are shown. Author

N74-21312*# Scientific Translation Service, Santa Barbara, Calif.
EFFECT OF ADSORBED WATER FILMS ON THE VAN DER WAALS FORCE BETWEEN QUARTZ GLASS SURFACES
H. Splittgerber and F. Wittman Washington NASA Apr. 1974

15 p refs Transl. into ENGLISH of Einfluss adsorbierter Wasserfilme auf die Van der Waals Kraft zwischen Quarzglasoberflaechen (West Germany), v. 41, no. 2, 1974 p 504-514
(Contract NASw-2483)
(NASA-TT-F-15448) Avail: NTIS HC $4.00 CSCL 20L

A method for determining Van der Waals forces at low distances is described. Results of experiments carried out with adsorbed water films are in excellent agreement with the theory of Dzyaloshinski. The thickness of adsorbed water films was varied by changing the vapor pressure of the surrounding atmosphere. The influence of thickness of adsorbed water films was studied. At high relative humidities the attractive force can be calculated with the help of Dzyaloshinski's theory by using the dielectric properties of water. The experimentally determined Van der Waals force is discussed in relation to the surface energy of the interface. Author

N74-21313# Ecole Polytechnique Federale de Lausanne (Switzerland). Centre de Recherches en Physique des Plasmas.
PARAMETRIC EXCITATION OF ALFVEN AND ACOUSTIC WAVES
The Hung Nguyen Oct. 1973 20 p refs Sponsored by Swiss Natl. Sci. Found.
(LRP-71/73) Avail: NTIS HC $4.00

The nonlinear interaction between two Alfven waves and a sound wave is studied, using the normal mode approach. This leads to a set of coupled equations, and consequently to a dispersion relation for the waves under consideration. It is shown that a large amplitude Alfven wave can give rise to two distinct types of parametric instabilities, namely the oscillating and the purely growing waves. In each case, the expressions for the threshold pump intensity, the frequency shift, and the growth rate of the excited waves are obtained. In particular, the results for a propagating pump under perfect frequency matching conditions are compared with those of Sagdeev and Galeev.
Author (ESRO)

N74-21314# Defence Research Information Centre, Orpington (England).
ABSORPTION OF WATERBORNE SOUND WAVES BY FORCED ALTERNATING FLOW OF FLUIDS
K. Meyer, K. Brendel, and J. Richter Jan. 1974 34 p refs Transl. into ENGLISH from Acustica (Stuttgart), v. 19, 1967/68 p 8-20
(DRIC-Trans-3389; BR30687) Avail: NTIS HC $4.75

The losses necessary for absorption were obtained by forced alternating flow of viscous fluids with a transformation of particle velocity. Using streaming fluids of a viscosity of some 1000 cP, fluid damped single and coupled resonant systems yield good absorption in a frequency range of up to three octaves. When fluids of smaller viscosity are used, difficulties arise in the adjustment of the necessarily smaller thickness of layer and thus in matching the absorber. Non-Newtonian properties prevent broad band matching with fluids of viscosities considerably larger than 1000 cP. In the frequency range of 250 Hz to 4 kHz, the impedance measurements are carried out in a pressure chamber, while a pulse tube is used between 4 kHz and 21 kHz.
Author (ESRO)

N74-21315# Naval Research Lab., Washington, D.C.
COHERENT SYNCHROTRON RADIATION FROM AN INTENSE RELATIVISTIC ELECTRON BEAM
Victor L. Granatstein, Melvin Herndon, Robert K. Parker, and Phillip Sprangle Jan. 1974 15 p refs
(AD-773442; NRL-MR-2706) Avail: NTIS CSCL 20/7

When an intense relativistic electron beam was made to traverse a magnetic field of novel configuration, about 25 MW of microwave power was measured in a narrowband pulse delta omega/omega (- or + 0.6%) centered near the relativistic electron cyclotron frequency. The emission angle was almost perpendicular to the applied magnetic field. The measured power is 10 to the 6th power larger than what can be accounted for on the basis of single particle synchrotron radiation. The process is thought to be similar to that previously reported in a low power (about 1 W) electron cyclotron maser. Author (GRA)

N74-21316# Cornell Univ., Ithaca, N.Y.
SURFACE CURRENT CONSTRUCTION OF RADIATION SPECTRA
Neal Maresca 25 Jan. 1974 16 p refs
(Contract N00014-67-A-0077-0015; NR Proj. 012-311)
(AD-773922; R1-74) Avail: NTIS CSCL 20/3

A technique is introduced which allows the spectral and angular distributions of radiation accompanying the interaction of a uniformly moving charge with a conducting surface to be obtained from surface currents constructed from sclution of the associated electrostatic problem. Application of the technique further employs simple arguments involving causality, conservation of charge, and the Lorentz transformation. Author (GRA)

N74-21317# Corning Glass Works, N.Y.
OPTIMIZATION OF OPTICAL WAVEGUIDES: ELECTRO-OPTIC STUDIES Final Technical Report, Feb. - Dec. 1973
R. D. Maurer, D. B. Keck, and B. J. Todd 15 Dec. 1973 31 p refs
(Contract N00014-73-C-0293; NR Proj. 039-119)
(AD-774733; FTR-1) Avail: NTIS CSCL 20/6

Experimental measurements of the spatial and temporal transfer of power of a 225 meter length of low-loss optical waveguide have been made. In particular, measurement of the angular attenuation showed substantial loss of the high order modes which reflected itself in an approximately 8.2 nsec/km decrease in measured dispersion. Additionally there was a reduction of the effective numerical aperture from 0.15 to 0.12. Negligible mode coupling was observed in this particular waveguide which allowed a phenomenological calculation of temporal output for an assumed uniform excitation of all modes. This agreed well with experimental measurements. Calculation of this output from knowledge of the index profile is presently not in agreement and some possible reasons are indicated. The first measurements of the temperature dependence of attenuation were made to determine the approximate size of the effect. Only small changes were detected up to about 400C.
Author (GRA)

N74-21318# Air Force Weapons Lab., Kirtland AFB, N.Mex.
MICROINCH MACHINING OF OPTICAL COMPONENTS FOR INFRARED OPTICS Final Report, Apr. - Oct. 1973
T. T. Saito Feb. 1974 34 p refs
(AF Proj. 317J)
(AD-774742; AFWL-TR-73-290) Avail: NTIS CSCL 20/6

Single-point diamond knives have been used on precision lathes to machine to microinch tolerances. This micromachining can also produce optics of high quality. The background and organizations involved in micromachining along with capabilities of micromachining optics are discussed. Optical evaluation of micromachined surfaces has been performed including scattering, reflectivity, absorption, and optical figure. Pulsed and continuous wave (CW) 10.6 micrometers data are presented and discussed. Although most evaluation has been done at 10.6 micrometers, measurements and discussion of possible uses of micromachined mirrors at visible wavelengths are included. Plans for research and development of micromachining are detailed. Author (GRA)

N74-21319# Ohio State Univ., Columbus. Electroscience Lab.
ISOPLANATIC PATCH SIZE MEASUREMENTS AT 10.6 MICRONS Semiannual Report
Edward K. Damon and W. G. Swarner Oct. 1973 16 p refs
(Contract F30602-73-C-0199; AF Proj. 1279; AF Proj. 317J)
(AD-774570; ESL-3638-1; RADC-TR-73-395) Avail: NTIS CSCL 20/6

Processing of atmospheric turbulence-degraded image data recorded at the RADC Verona Test Site is described with some results given. The dual-beam infrared scanner constructed to record this information is being redesigned for a new format, and progress on this design task is reported. Author (GRA)

N74-21320# Ohio State Univ., Columbus.
AUTOMATIC RECOGNITION OF COMPLEX THREE-DIMENSIONAL OBJECTS FROM OPTICAL IMAGES
Robert B. McGhee Oct. 1973 28 p refs Presented at US-Japan Seminar on Learning Control and Intelligent Control, Gainesville, Fla., 22-26 Oct. 1973
(Contract AF-AFOSR-2048-71; AF Proj. 9769)
(AD-774103; AFOSR-74-0090TR) Avail: NTIS CSCL 17/8

The paper surveys techniques which have been used for

automatic recognition of aircraft and other complex three-dimensional objects from optical images. All methods reported in unclassified literature are described and compared. A detailed description of an experimental system using live television images is included. This system makes use of certain features derived from the central moments of a binary image of the object. These features, called moment invariants are invariant with image rotation, translation, and size. It is reported that a classification error rate of only five percent was obtained in a laboratory experiment involving noisy images of six aircraft types. Human error rates in classifying the same images averaged ten percent. Author (GRA)

N74-21450* American Science and Engineering, Inc., Cambridge, Mass.
POSSIBLE LOW ENERGY (E LESS THAN keV) NONTHERMAL X-RAY EVENTS
S. W. Kahler *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 124-131 refs (For availability see N74-21440 12-30)
CSCL 03B

N74-21451* California Univ., San Diego.
THERMAL AND NONTHERMAL X-RAY BURSTS OBSERVED FROM OSO-7
L. E. Peterson, D. W. Datlowe, and D. L. McKenzie *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 132-146 refs (For availability see N74-21440 12-30)
(Contract NAS5-11081)
CSCL 03B

N74-21453* Columbia Univ., New York. Columbia Astrophysics Lab.
HIGH-ENERGY SOLAR X-RAY POLARIMETRY
R. S. Wolff *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 162-175 refs (For availability see N74-21440 12-30)
(Grants NGR-33-008-125; AF-AFOSR-70-1945)
CSCL 03B

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N74-21321 Yale Univ., New Haven, Conn.
MEASUREMENT OF THE RADIATIVE LIFETIMES OF THE KRYPTON II 5 SUB P LASER LEVELS Ph.D. Thesis
Keith Edwin Donnelly 1973 140 p
Avail: Univ. Microfilms Order No. 74-2174

The radiative lifetimes of the levels of the Kr II 5 sub p configuration were measured by a transient decay technique. Levels are excited by a fast pulse of threshold energy electrons and their decay is observed on an isolated optical transition. Decay curves are obtained by a multichannel delayed coincidence method. A technique is described for the determination of correct terminating impedances of a transmission line electron gun by time domain reflectometry. Also included is a study of the properties of the parameters that are obtained in a least squares fit, with emphasis on the errors that occur when one is forced to fit with a function with fewer parameters. Dissert. Abstr.

N74-21322 Illinois Univ., Urbana.
MOLECULAR ROTATIONAL ZEEMAN EFFECT AND SUPERSONIC NOZZLE BEAM-MICROWAVE SPECTROMETER STUDIES Ph.D. Thesis
Steven Lee Rock 1973 157 p
Avail: Univ. Microfilms Order No. 74-5675

Molecular rotational Zeeman effect studies have been carried out on two groups of molecules one containing fluorine and the other containing atoms in the third and fourth rows of the periodic table. An introduction to Zeeman effect studies using microwave spectroscopy is presented. Magnetic susceptibility results are reviewed for the fluorine containing molecules. Trends in the out-of-plane minus the average inplane magnetic susceptibility anisotropy due to in-plane fluorine substitution are analyzed for various bonding situations. Zeeman results for molecules containing higher row atoms are presented separately for groups IV A - VII A. Magnetic susceptibility trends and electron distribution information are compared for each group. Overall trends for the higher row atoms are cited. Dissert. Abstr.

N74-21323# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
CALCULATION OF ELECTROSTATIC GUNS FOR ION PROPULSION
Marc Pointeau 1972 62 p refs In FRENCH; ENGLISH Summary
(ONERA-TN-206) Avail: NTIS HC $6.25

Electrostatic focusing of an ion flux issued from a porous tungsten pellet is discussed. The main equation governing the phenomenon is the Poisson equation. It is solved in an iterative, self-consistent manner. The calculation of electric potential is ensured by discretization and resolution of the matrix equation obtained by the overrelaxed Gauss-Seidel method. Space charge is obtained by flowrate conservation in stream tubes resting on three adjoining trajectories. The computation program established permits the study of two dimensional or axisymmetrical beams. A sub program gives the beam divergence and the thrust. This program was used to test the optics of a button-type thrustor, and the influence of outlet beam neutralization on trajectories. Another program treats the deflection of a two dimensional beam, and a third one evaluates the electrode erosion by secondary ions. Author

N74-21324# Stanford Univ., Calif. Microwave Lab.
BOND ORBITAL MODEL 2
W. A. Harrison and S. Ciraci Apr. 1974 45 p refs Submitted for publication
(Grant NSF GP-25945)
(SU-ML-2286) Avail: NTIS HC $5.25

The bond orbital model is reformulated taking explicit account of the large overlap of two hybrids in the same bond rather than absorbing it in a pseudopotential. This gives a correction to the cohesive energy but other changes are absorbed in the V sub 1, V sub 2, and V sub 3 for each material. These parameters are re-evaluated taking band calculations as the standard for V sub 1 (but using the atomic term values to scale from material to material) and taking the energy of the optical absorption peak as the standard for V sub 2 and V sub 3 (but using the dielectric constant to scale from material to material). Author

N74-21325# Institut Franco-Allemand de Recherches, St. Louis (France).
IONIZATION OF SIMPLE GASES IN A NEW ALPHA PARTICLE AND ELECTRON BOMBARDMENT ION SOURCE AND CALCULATION OF IONIZATION CROSS SECTIONS [IONISIERUNG EINFACHER GASE DURCH IONENSTOSS IN EINER NEUEN ALPHA-, E-STOSS-IONENQUELLE UND BERECHNUNG DER IONISATIONSQUERSCHNITTE]
F. Daeublin 22 Dec. 1972 43 p refs In GERMAN
(ISL-38/72) Avail: NTIS HC $5.25

The ionization cross sections of a series of simple gases (He, Ne, Kr, ... CH4, C2H6, C3H8....N2, 02, etc) were determined using a newly developed alpha- ,electron-bombardment ion source through alpha particle bombardment. The alpha particle source was a 200 mCi-polonium preparation. The particle energy was 3.5 MeV after passage through a Ni window. By way of comparison, the ionization cross sections for electron impact were also determined. The electrons were produced by a heated cathode. By acceleration in an electric field, impact energies of 75 eV and 475 eV were obtained. In addition, the mass spectra of the gases were compared for alpha and electron bombardment. According to predictions of mass spectra theory, the obtained mass spectra should be similar. With the exception of small deviations in the light molecule fragments, these predictions could be confirmed. ESRO

N74-21456* Ohio State Univ., Columbus. Dept. of Electrical Engineering.
GYROSYNCHROTRON RADIATION FORMULAE

H. C. Ko *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 198-206 refs Sponsored in part by AFCRL (For availability see N74-21440 12-30)
CSCL 03B

N74-21465* Chicago Univ., Ill. Enrico Fermi Inst. and Dept. of Physics.
SOLAR FLARE ACCELERATED ISOTOPES OF HYDROGEN AND HELIUM
J. D. Anglin, W. F. Dietrich, and J. A. Simpson *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 315-340 refs (For availability see N74-21440 12-30)
(Grants NGL-14-001-006; NSF GA-28368X)
CSCL 03B

N74-21466* California Inst. of Tech., Pasadena.
THE ISOTOPES OF H AND He IN SOLAR COSMIC RAYS
T. L. Garrard, E. C. Stone, and R. E. Vogt *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 341-354 refs (For availability see N74-21440 12-30)
(Contract NAS5-9312; Grant NGR-05-002-160)
CSCL 03B

N74-21467* Dartmouth Coll., Hanover, N.H. Radiophysics Lab.
MAGNETIC FIELD RECONNECTION AND PARTICLE ACCELERATION
B. U. O. Sonnerup *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 357-376 refs (For availability see N74-21440 12-30)
(Grant NGR-30-001-040)
CSCL 03B

N74-21468* California Univ., Berkeley. Dept. of Physics.
COMPOSITION AND ENERGY SPECTRA OF SOLAR PARTICLES
P. B. Price *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 377-392 refs (For availability see N74-21440 12-30)
(Contract NAS9-12005; Grants NGR-05-003-376; NGL-05-002-410; Contract AT(04-3)-34)
CSCL 03B

N74-21469* Chicago Univ., Ill. Enrico Fermi Inst.
A MECHANISM FOR THE ABUNDANCE ENHANCEMENTS OF HEAVY NUCLEI IN SOLAR FLARE PARTICLE EVENTS
Brian G. Cartwright and Antonio Mogro-Campero *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 393-403 refs (For availability see N74-21440 12-30)
(Contract NAS5-9366; Grants NGL-14-001-006; NSF GA-28368X)
CSCL 03B

N74-21470* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR COSMIC RAY MICRO-EVENTS
F. B. McDonald and M. A. VanHollebeke *In its* High Energy Phenomena on the Sun 1973 p 404-417 refs (For availability see N74-21440 12-30)
CSCL 03B

N74-21472* Bell Telephone Labs., Inc., New York.
SOLAR FLARE ALPHA PARTICLES
L. J. Lanzerotti *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 427-438 refs (For availability see N74-21440 12-30)
CSCL 03B

N74-21474* High Altitude Observatory, Boulder, Colo.
CORONAL MAGNETIC FIELDS AND ENERGETIC PARTICLES
Gordon Newkirk, Jr. *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 453-477 refs (For availability see N74-21440 12-30)
(Contract N00014-66-C-0239; NR Proj. 013-023)
CSCL 03B

N74-21475* Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
A LOWER LIMIT TO THE ALTITUDE OF CORONAL PARTICLE STORAGE REGIONS DEDUCED FROM SOLAR PROTON ENERGY SPECTRA
S. M. Krimigis *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 478-485 refs (For availability see N74-21440 12-30)
(Contract N00017-72-C-4401)
CSCL 03B

N74-21476* New Hampshire Univ., Durham. Dept. of Physics.
CORONAL PROPAGATION OF ENERGETIC CHARGED PARTICLES
E. C. Roelof *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 486-502 refs (For availability see N74-21440 12-30)
(Contract F19628-73-C-0070; NOAA-03-3-022-41)
CSCL 03B

N74-21477* California Univ., Riverside. Dept. of Physics and Inst. of Geophysics and Planetary Physics.
ENERGETIC PARTICLE STORAGE ON THE SUN
G. M. Simnett *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 503-515 refs (For availability see N74-21440 12-30)
CSCL 03B

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N74-21326 Case Western Reserve Univ., Cleveland, Ohio.
INTERACTION OF A PLASMA BEAM WITH A MAGNETIC BARRIER Ph.D. Thesis
J. -J. Lee 1973 122 p
Avail: Univ. Microfilms Order No. 74-2539

A supersonic He plasma beam (200 ev, 10 to the 15th power/cu cm) was generated, and the interaction of this highly conducting plasma with a transverse quasi step-like magnetic barrier (2.4 KG) was studied. Time-resolved photographic observation and measurements by the standard techniques of spectroscopy, laser interferometry and a double probe were performed. The results obtained indicated that a collisionless electrostatic shock was excited in front of the barrier as a result of the drastic compression. The initially cold plasma was substantially thermalized by the shock, and the electron density increased by a factor of approximately 4. The estimated shock thickness was 2-3 cm. The plasma penetrated the barrier in the form of a sheet oriented in the field direction as reported by Scott. Under certain experimental conditions the penetration was in the form of discrete blobs. For this nonuniform shock, a simple dynamic model was given, and the shock path was numerically determined. Dissert. Abstr.

N74-21327 Pennsylvania State Univ., University Park.
AN INVESTIGATION OF THE TRANSIENT PLASMA FLOW FROM A SELF-FIELD PINCH DISCHARGE Ph.D. Thesis
Kenneth Francis McKenna 1973 199 p
Avail: Univ. Microfilms Order No. 74-4274

The transient plasma flow from a self field pinch discharge was experimentally examined. The investigation was conducted utilizing a cylindrical Z-pinch, with 70 millitorr uniform argon fill pressure and reversible electrode polarity, in two configurations: (1) a solid chamber electrode geometry, and (2) an axial orifice in the outer electrode facing into an exhaust vessel. The 130 kA, 8 micro sec duration, driving current pulse was approximately constant and non-reversing. Pressure, velocity, electric, and magnetic field probes along with luminosity photography and total voltage probes were used to study the chamber source flow and the expansion flow into a 6-inch diameter exhaust vessel. The current sheet and pinched plasma column were examined. The current sheet sweeping efficiency and plasma column thermal properties were found to be the same in both

pinch configurations. Anode to cathode ion streaming was identified and related to a definable current sheet tilt which electromagnetically induced axial ion motion. Dissert. Abstr.

N74-21328 Princeton Univ., N.J.
ANALYSIS OF ACCELERATION MECHANISMS AND PERFORMANCE OF AN APPLIED FIELD MPD ARCJET Ph.D. Thesis
David Barry Fradkin 1973 218 p
Avail: Univ. Microfilms Order No. 74-2329

An analysis of the performance and acceleration mechanisms of an applied field lithium fueled MPD arcjet operating in the power range of 10 kW to 35 kW is presented. Overall performance measurements include the determination of arc current-voltage characteristics, thermal efficiency, thrust, and thrust efficiency. Beam diagnostics experiments include the determination of axial and rotational particle velocities, ion and electron temperatures, electron densities, and current densities. Results of these measurements show that the arc produces a highly ionized beam which typically carries with it 70% of the input electrical power. The ability of the device to accelerate lithium ions to velocities of propulsion interest, values approaching 3 x 10000 m/sec, is well established by these experiments. Thrust efficiencies greater than 40% are indicated. Dissert. Abstr.

N74-21329 Colorado State Univ., Fort Collins.
PLASMA-SOLID INTERFACE ENERGY TRANSPORT Ph.D. Thesis
Masanobu Niimura 1973 290 p
Avail: Univ. Microfilms Order No. 74-5438

A quantitative investigation was made of the arc energy transport across a plasma-solid interface. In particular, the effect of external and internal electric fields on the thermal conductivity was investigated. High electric fields exist at the interface due to the large gradients of the plasma parameters and departs the plasma from local thermodynamic-equilibrium (LTE). This situation makes accurate energy transport calculations at the interface difficult. A unified theory to treat the effect of electric fields was developed by introducing a generalized thermal conductivity and/or generalized correction factor for the conventional thermal conductivity. The radial and axial energy equations including all the important transport terms and the field correction factors were evaluated. The state of plasma is described by a two-temperature gas in the high electric field regions. A comprehensive formula useful for the calculation of both the anode and cathode fall energy transports was presented.
Dissert. Abstr.

N74-21330 Texas Univ., Austin.
MEASURED STARK BROADENING IN AN INTERMEDIATE DENSITY PLASMA Ph.D. Thesis
Gerald Ray Chester 1973 177 p
Avail: Univ. Microfilms Order No. 74-5212

Stark profiles for the Balmer series, through H(0), ranging from four orders of magnitude in intensity for H-Beta to two orders for H(10), were measured in a Z-discharge over the electron density and temperature ranges 2 to 8 x 10 to the 14th power/cu cm and 1-2 eV, respectively. Homogeneity measurements of the source showed that the electron density is uniform to within + or - +4% for 90% of the optical path. Boundary layer effects are believed to be neglible. The profiles were compared with the unified theory of Vidal, Cooper, and Smith and modified impact theory of Kepple and Griem. Overall agreement between the experiment and theories was better than 5% for all lines studied. Measured core structure was always less pronounced than theoretical predictions. The H-Beta, H-Delta, and H-Epsilon showed an indication of slightly faster wing slopes than the tranditional 5/2. Despite satisfying the validity criterion for partial-L.T.E., the measured atomic state densities for principle quantum numbers four through ten were 40 to 250 times larger than the values calculated from the Saha-Boltzmann equation. Dissert. Abstr.

N74-21331 Brown Univ., Providence, R.I.
MAGNETOPLASMA SURFACE WAVES IN METALS AND SEMICONDUCTORS Ph.D. Thesis
K. -W. Chiu 1973 115 p
Avail: Univ. Microfilms Order No. 74-2994

A macroscopic theory of surface plasmons in metals or degenerate semiconductors in the presence of an applied magnetic field is developed. For a completely arbitrary applied magnetic field, the magnetoplasma surface waves are investigated in the nonretarded limit in which their phase velocity is negligible compared to the velocity of light. A simple equation is derived which gives the dependence of the surface plasmon frequency on the magnitude and orientation of the applied magnetic field. By including the effects of retardation, surface polariton dispersion curves are obtained. Surface polaritons in metals and polar semiconductors are studied for several different orientations of the applied field. The dispersion curves display a surprising amount of interesting new structure which does not occur in the absence of the dc magnetic field. Dissert. Abstr.

N74-21332# Joint Publications Research Service, Arlington, Va.
STUDY OF THE PARAMETERS AND DYNAMICS OF A LASER PLASMA
V. A. Boyko, O. N. Krokhin, and G. V. Sklizkov 2 Apr. 1974 75 p refs Transl. into ENGLISH of the book "Issledovaniye Parametrov i Dinamiki Lazernoy Plazmy" Moscow, Preprint no. 121, 1972 13 p
(JPRS-61638; Preprint-121) Avail: NTIS HC $6.75

The characteristic parameters are discussed of a laser flare, plasma temperature measurements, the anisotropy of the separation of the laser flare ions, the ionization state of multicharge laser plasma, and laser plasma as a source of multicharge ions.
Author

N74-21333# Joint Publications Research Service, Arlington, Va.
HIGHLY EFFICIENT SUPERSONIC NONEQUILIBRIUM MHD GENERATOR
A. D. Belykh, V. A. Gurashvili, and V. S. Golubev 2 Apr. 1974 6 p refs Transl. into ENGLISH from Teplofiz. Vys. Temp. (Moscow), v. 11, no. 6, 1973 p 1289-1291
(JPRS-61637) Avail: NTIS HC $4.00

The results are presented of an experiment to prove the feasibility of effective MHD-deceleration of plasma with nonequilibrium conductivity and high output power (approximately 1,00,000 W).
Author

N74-21334*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PARAMETRIC STUDY OF ION HEATING IN A BURNOUT DEVICE (HIP-1)
Donald R. Sigman, John J. Reinmann, and Milton R. Lauver Washington Apr. 1974 19 p refs
(NASA-TM-X-3033; E-7766) Avail: NTIS HC $3.00 CSCL 20I

Results of further studies on the Lewis Research Center hot-ion plasma source (HIP-1) are reported. Changes have been made in both the electrode geometry and materials to produce higher ion temperatures. Ion temperature increased significantly with increased vacuum pumping speed. The best ion temperatures achieved, so far, for H(+), D(+), and He(+) plasmas are estimated to be equal to, or greater than 0.6, equal to, or greater than 0.9, and equal to, greater than 2.0 keV, respectively. Electrode pairs produced high ion temperatures whether on the magnetic axis or off it by 5.5 cm. Multiple sources, one on-axis and one off-axis, were run simultaneously from a single power supply by using independent gas feed rates. A momentum analyzer has been added to the charge-exchange neutral particle analyzer to identify particles according to mass, as well as energy. Under any given plasma condition, the higher mass ions have higher average energies but not by as much as the ratio of their respective masses.
Author

N74-21335# Sydney Univ. (Australia). Wills Plasma Physics Dept.
[PLASMA PHYSICS RESEARCH, INCLUDING MHD SHOCK WAVES, MICROWAVES, ION CYCLOTRON, FAR INFRARED, AND PLASMA SOURCE AND ROTATION STUDIES] Semiannual Progress Report, 1 Jan. - 30 Jun. 1973
30 Jun. 1973 12 p refs
(NP-19860; SAPR-25) Avail: AEC Depository Libraries HC $3.00

Summaries are given of experimental progress in plasma sources, hydromagnetic shock waves, rotating plasmas, microwaves, and far infrared work. NSA

N74-21336# Ecole Polytechnique Federale de Lausanne (Switzerland). Centre de Recherches en Physique des Plasmas.
STUDY OF THE EIGENMODES OF A CYLINDRICAL PLASMA USING THE FINITE ELEMENT METHOD [STUDIUM DER EIGENSCHWINGUNGEN EINES ZYLINDRISCHEN PLASMAS MIT DER METHODE DER FINITEN ELEMENTE]
K. Appert, D. Berger, R. Gruber, F. Troyon, and J. Rappaz Sep. 1973 22 p refs In GERMAN; ENGLISH summary Sponsored by Swiss Natl. Sci. Found.
(LRP-66/73) Avail: NTIS HC $4.25

The eigenmodes of a cylindrical homogeneous plasma may be calculated analytically. There are three classes of solutions. The eigenvalues of the first class are well separated, those of the second class have a point of accumulation. The eigenvalue of the third class is infinitely degenerated. The eigenvalues and eigenmodes of the corresponding discrete finite element problem tend towards the true solution. The convergence properties are discussed. Author (ESRO)

N74-21337# Ecole Polytechnique Federale de Lausanne (Switzerland).
TRANSFER FUNCTION OF FEEDBACK STABILIZED HELICOIDAL PINCH [LA FONCTION DE TRANSFERT D'UN PINCH HELICOIDAL STABILISE PAR RETROACTION CSS CENTRE DE RECHERCHES EN PHYSIQUE DES PLASMAS.]
R. Keller Nov. 1973 26 p refs In FRENCH; ENGLISH summary
(LRP-73/73) Avail: NTIS HC $4.50

The feedback control system to be used for stabilizing the kink mode of a screw pinch was analyzed. Optical and magnetic detection systems are compared, taking into account the coupling between the probe and the feedback control windings. Impedance of the feedback amplifier was found to be positive or negative, depending on stability conditions. Author (ESRO)

N74-21338# Ecole Polytechnique Federale de Lausanne (Switzerland). Centre de Recherches en Physique des Plasmas.
MAGNETIC FIELD MEASUREMENTS IN A CURVED THETA PINCH WITH LIMITERS
F. Hofmann and A. Simik Nov. 1973 17 p refs Sponsored by Swiss Natl. Sci. Found.
(LRP-74/73) Avail: NTIS HC $4.00

The curved theta pinch experiment, which uses an oscillating axial current to establish a toroidal equilibrium, was modified by introducing quartz limiters at the ends of the discharge tube. Recent measurements on the new version of the device are described. In contrast to previous experiments, the oscillating axial current flows mainly through the dense plasma column. Author (ESRO)

N74-21339# Ecole Polytechnique Federale de Lausanne (Switzerland). Centre de Recherches en Physique des Plasmas.
A USEFUL FORM OF THE VARIATIONAL PRINCIPLE OF IDEAL MHD FOR ONE-DIMENSIONAL NUMERICAL STABILITY CALCULATIONS
K. Appert, D. Berger, and R. Gruber Dec. 1973 11 p refs Sponsored by Swiss Natl. Sci. Found.
(LRP-76/73) Avail: NTIS HC $4.00

The variational problem of an ideal one-dimensional MHD stability is treated by the method of Ritz-Galerkin. Finite elements are taken as the basic functions. In order to find the best approximating elements a radius dependent transformation was performed on the eigenvectors. The matrices of the transformed eigenvalue problem are given. Author (ESRO)

N74-21340# Ecole Polytechnique Federale de Lausanne (Switzerland). Centre de Recherches en Physique des Plasmas.
A PLASMA BOX USING MAGNETIC MULTIPOLE CONFINEMENT
P. J. Hirt and M. Q. Tran Dec. 1973 28 p refs Sponsored by Swiss Natl. Sci. Found.
(LRP-77/73) Avail: NTIS HC $4.50

A plasma box using alternating magnetic multipole confinement is described. With disk shaped magnets, a good confinement is achieved with plasma lifetime being on the order of 200 micros. A very low electron emission current (200 mA, heating power 250 VA) is required to maintain densities up to (2 x 10 to the 9th power)/cu cm in Argon, with an electron temperature of 2.5 eV and an ion temperature of 0.8 eV. The temperature ratio may be changed with a Maxwell demon between 2.0 and 5.3. Author (ESRO)

N74-21341# Stuttgart Univ. (West Germany). Inst. fuer Plasmaforschung.
[RESEARCH ACTIVITIES OF THE INSTITUTE OF PLASMA PHYSICS] Annual Report, 1972 [FORSCHUNGSBERICHT 1972]
[1973] 92 p ref Partly in GERMAN and partly in ENGLISH Avail: NTIS HC $7.75

A survey of scientific work carried out during the year 1972 is presented. The research program was narrowed down to some main problem areas, such as plasma waves, plasma focusing, transient diagnostics, and laser applications. ESRO

N74-21342# Stuttgart Univ. (West Germany). Inst. fuer Plasmaforschung.
INSTABILITY OF THE POSITIVE COLUMN OF A DIFFUSION DOMINATED LOW PRESSURE GAS DISCHARGE IN A LONGITUDINAL HOMOGENEOUS MAGNETIC FIELD [DAS INSTABILITAETSVERHALTEN DER POSITIVEN SAEULE EINER DIFFUSIONSBESTIMMTEN NIEDERDRUCKGASENTLADUNG IM LONGITUDINALEN, HOMOGENEN MAGNETFELD]
F. Moser 1973 111 p refs In GERMAN
(IPF-73-1) Avail: NTIS HC $8.75

Basic equations valid for positive plasma columns of relatively high pressure, were used to investigate, theoretically, the stability behavior of low pressure gas discharge columns. The dispersion equation for the propagation of cylindrical waves in a long unlimited positive column within a longitudinal, homogeneous magnetic field, was derived from the Schottky equilibrium solution using a perturbation law for the density and the potential. This dispersion equation was used to investigate the stability of the positive column in the magnetic field. ESRO

N74-21343# Stuttgart Univ. (West Germany). Inst. fuer Plasmaforschung.
NUMERICAL PARAMETER STUDIES FOR THE PLASMA FOCUS [NUMERISCHE PARAMETERSTUDIEN FUER DEN PLASMAFOKUS]
M. Trunk 1973 70 p refs In GERMAN
(IPF-73-2) Avail: NTIS HC $6.50

A computer program was developed for the magnetohydrodynamic focus code to produce the necessary parameters for two plasma focusing machines: Minifocus and Nessi. The effectivity of these focusing machines was investigated by means of energy methods. By varying the parameters of the plasma focus, the MHD code allows determination of the most efficient utilization of the capacitor battery as well as the most favorable plasma variables for the focus phase. It is expected that the overall conditions are most favorable when both optima coincide. The most important condition for good focusing is a high current in the collapse phase. ESRO

N74-21344# European Space Research Organization, Paris (France).
THEORETICAL FLOW FIELD ANALYSIS FOR THE ANNULAR HALL ACCELERATOR
Klaus Robert Feb. 1974 40 p refs Transl. into ENGLISH of "Theoretische Stroemungsfelduntersuchungen am ringfoermigen Hall-Beschleuniger", DFVLR, Inst. fuer Angewandte Gasdyn., Porz-Wahn, West Germany, report DLR-FB-73-45, 1973
(ESRO-TT-18; DLR-FB-73-45) Avail: NTIS HC $5.00; DFVLR Porz-Wahn: 14,30 DM

Steady, barotropic, and inviscid flows of a rarefied gas plasma through an axisymmetric annular channel are studied with imposed axial electric field and radial magnetic induction. By means of a previously developed first-order perturbation analysis, closed form solutions for the electric current density are obtained. The flow velocity and mass density of the plasma within the

annular duct for supersonic and subsonic conditions and arbitrary values of the Hall parameter are also discussed. Author (ESRO)

N74-21345# Naval Postgraduate School, Monterey, Calif.
NON-EQUILIBRIUM EFFECTS IN FAST MOVING PLASMAS Annual Summary Report, Mar. 1972 - Jun. 1973
A. W. Cooper and F. Schwirzke Jul. 1973 23 p refs
(AD-773439; NPS-61SW/CR73121A) Avail: NTIS CSCL 20/9

The dependence of the self-generated magnetic fields associated with a laser-produced plasma on position, time, and background pressure has been investigated. The presence of the ambient background is found to influence the generation of the fields during the laser irradiation of the plasma. This influence continues long after laser shut-off and causes the fields to reverse their direction. Author (GRA)

N74-21346# Naval Research Lab., Washington, D.C.
SPHERICAL IMPLOSION OF THICK LINERS WITH COMPRESSIBILITY AND PLASMA LOSS
Peter J. Turchi Jan. 1974 48 p refs
(rr0110941)
(AD-774483; NRL-MR-2711) Avail: NTIS CSCL 20/9

Fusion reactors based on imploding liner flux compression can use the imploded liners surrounding the reacting plasma as a neutron-absorbing blanket and thermal reservoir. In this report, the final stages of liner-plasma compression are modelled in terms of the one-dimensional implosion of a thick, spherical shell. Spindle cusp plasma confinement is assumed, with plasma loss by particle efflux through the ring and point cusps. The liner material is treated as an inviscid, incompressible fluid. Compressibility effects are included in the liner motion, however, by correcting for energy loss to liner material compression. (Modified author abstract) GRA

N74-21347# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
CYLINDRICAL ANTENNA IN A HOT PLASMA: A GENERAL ANALYSIS INCLUDING LONGITUDINAL WAVE EXCITATION EFFECTS
Michael A. V. Ward Nov. 1973 73 p refs
(Contract N00014-67-A-0298-0005; Grant NSF GK-24; TVR Proj. 372-016)
(AD-774689; TR-648) Avail: NTIS CSCL 09/5

The semi-infinite Fourier transform is developed and, along with suitable boundary conditions, used to obtain a general expression for the current distribution on the exterior of a cylindrical antenna immersed in a hot, isotropic plasma. The kinetic theory formulation incorporating the Vlasov equation is followed with the discontinuity in the longitudinal wave across the antenna surface included in the analysis. Author (GRA)

N74-21348# Wright State Univ., Dayton, Ohio. Dept. of Physics.
ELECTRON PLASMA DENSITY DETERMINATIONS WITH A 50 GHz FABRY-PEROT INTERFEROMETER Interim Report
Merrill L. Andrews and John S. Martin Nov. 1973 40 p refs
(Contract F33615-69-C-1842; AF Proj. 7073)
(AD-774453; ARL-73-0113) Avail: NTIS CSCL 20/9

A microwave Fabry-Perot interferometer operating in the 50 GHz region has been analyzed and employed in the measurement of electron densities within a plasma. Both volume perturbation and ray refraction approaches have been applied to determine the practical limits of the system. In the symmetric spherical mirror geometry a mirror separation approaching the concentric configuration proved least susceptible to plasma refraction limitations. After limiting the resonances to the lowest order modes with apertures the general resonance shift was found to agree with calculations when known dielectric perturbations were used. To follow resonance shifts within the plasma chamber where mirror separation could not be varied a swept impatt diode generator was employed. (Modified author abstract) GRA

N74-21349# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE THEORY OF LOCAL HYDROMAGNETIC STABILITY OF TOROIDAL PLASMA CONFIGURATIONS
A. B. Mikhailovskii 28 Dec. 1973 24 p refs Transl. into ENGLISH from Zh. Eksperim. Teor. Fiz. (Moscow), v. 64, no. 2, 1973 p 536-547
(AD-774383; FTD-HT-23-747-74) Avail: NTIS CSCL 20/9

It is pointed out that despite an abundance of investigations of hydromagnetic stability of toroidal plasma configurations, the problem still remains unsolved. In particular, the meaning of the general geometric Mercier criterion which plays an important role in modern calculations of stability of concrete systems remains unclear. A general theory of local instability is developed in the present paper from which it followed that the Mercier criterion is a necessary and sufficient condition for plasma stability with respect to a particular class of local perturbations, such as those for which the radial wavelength is small with respect to the wavelength along the small azimuth. GRA

N74-21350# Naval Postgraduate School, Monterey, Calif.
AN INVESTIGATION OF EARLY DISTURBANCES FOUND IN ASSOCIATION WITH LASER-PRODUCED PLASMAS M.S. Thesis
Kenneth Montgomery Brooks, Sr. Dec. 1973 125 p refs
(AD-774089) Avail: NTIS CSCL 20/9

A plasma was produced by the interaction of 300 MW, 25 nsec, Nd laser pulse with an aluminum target. The resulting plasma expanded into an ambient background of 0.000025 torr and was analyzed using floating double probes, magnetic probes and a quartz pressure probe. An early disturbance was noted before arrival of the main plasma. Further experiments separate this early signal into photoelectric response and two fast plasma pulses traveling with constant speeds of 1.1 X 10 to the 8th power cm/sec and 5.9 X 10 to the 7th power cm/sec. (Modified author abstract) GRA

N74-21351# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HEAT FLOW DISTRIBUTION IN THE OUTER ELECTRODE IN A QUASI-STATIONARY PLASMA ACCELERATOR
A. M. Dorodnov, A. B. Ivashkin, and N. P. Kozlov 29 Jan. 1974 15 p ref Transl. into ENGLISH from Samoletostroenie i Tekhn. Vozdushnogo Flota (USSR), no. 25, 1971 p 54-60
(AD-774402; FTD-HT-23-179-74) Avail: NTIS CSCL 20/9

The heat flow distribution in a coaxial plasma accelerator model was measured and analyzed, and the dependence of the heat flow in the outer electrode on the discharge current was established. Nonuniformity of the current flow along the outer electrode was attributed to the presence of anisotropy of conductivity in the plasma accelerator cavity. It was shown that the current line distribution in a coaxial system of electrodes is inversely proportional to the size of the Hall parameter for the ions. G.G.

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N74-21352 Southern Methodist Univ., Dallas, Tex.
ALUMINUM NITRIDE AS A DIELECTRIC FOR SILICON DEVICES Ph.D. Thesis
Reynold William Kelm 1973 142 p
Avail: Univ. Microfilms Order No. 74-5171

The preparation and characterization of thin films of aluminum nitride deposited on silicon substrates are discussed. Aluminum nitride crystallizes in the Wurt-zite structure with lattice parameters a = 3.11 A and c = 4.89 A. Aluminum nitride films of 300 to 20,000 A in thickness were deposited on the (111) surfaces of silicon substrates by the pyrolysis of AlCl3 3NH3 at 800 deg - 1100 C in an open tube gas flow system. The deposited films were found to be polycrystalline by transmission electron microscopy, and the crystallinity on the films was a strong function of temperature. The density, dissolution rate, and optical absorption of aluminum nitride films were also found to be function of deposition temperature, while the refractive index was found to be independent of deposition temperature. The electrical

properties of thin films of aluminum nitride on silicon substrates were investigated using a metal-aluminum nitride-silicon-metal structure. Dissert. Abstr.

N74-21353 Ohio State Univ., Columbus.
MEASUREMENTS OF THE KAPITZA BOUNDARY CONDUCTANCE BETWEEN GALLIUM SINGLE CRYSTALS AND LIQUID HELIUM 2 Ph.D. Thesis
Francis Joseph Kollarits 1973 254 p
Avail: Univ. Microfilms Order No. 74-3222

The Kapitza boundary conductance of single crystal gallium-helium 2 interfaces as a function of crystal orientation in the temperature range 1.2 to 2.0K were measured. The measurements were performed using a version of the second sound technique of Brown and Osborne. The results are interpreted as evidence for the existence of an electronic contribution to the Kapitza boundary conductance in gallium. The coupling between the conduction electrons in gallium and the helium phonons appears to be of the type suggested by Little between the surface produced by the so-called totally reflected helium phonons and the conduction electrons in the metal. Dissert. Abstr.

N74-21354 University of Southern Calif., Los Angeles.
GROWTH AND CHARACTERIZATION OF GaAs AND MIXED III-V SEMICONDUCTOR COMPOUNDS Ph.D. Thesis
Vincent Fook Seng Yip 1973 234 p
Avail: Univ. Microfilms Order No. 74-5881

The travelling heater method (THM) is a crystal growth technique in which a solvent zone is caused to move through a solid feed material by movement relative to the heater. In this research investigation GaAs, GaxIn1-xSb and GaxAl1-xAs were grown by the THM and the material characterized by different techniques and analyses. The cylindrical feed GaAs for THM experiments was grown by the vertical gradient freeze method. The solvent used was high purity Ga and the single crystal GaAs seeds were shaped from Czochralski grown crystals. A systemic investigation was made on the influence of the various parameters such as temperature and lowering rate, feed and crystal lengths, zone length and growth interface shape on THM growth and the quality of GaAs grown. Dissert. Abstr.

N74-21355 Texas Univ., Austin.
ENERGY BAND CALCULATIONS, METALS AND SEMICONDUCTORS, BULK AND SURFACE PROPERTIES Ph.D. Thesis
Edward Blair Caruthers, Jr. 1973 100 p
Avail: Univ. Microfilms Order No. 74-5209

Energy band calculations were performed on both the high and low temperature phases of vanadium dioxide and on thin films of aluminum. The purpose of the first two calculations was to try and understand the metal-semiconductor transition, while the purpose of the third was to investigate the effects of surfaces on band structure. Above 68 C VO2 is a rather poor metal with rutile structure. A modified augmented plane wave calculation was performed for this structure, using a semi-empirical potential chosen to give agreement with the experimentally determined difference between the Fermi energy and the energy at the top of the O2p band. A parameterized linear combination of atomic orbitals calculation was fit to the three points in the Brillouin zone at which APW energy levels had been calculated, and the resultant energy bands and density of states are presented. Dissert. Abstr.

N74-21356 Stanford Univ., Calif.
PHOTOCONDUCTIVITY AND RECOMBINATION KINETICS IN AMORPHOUS CHALCOGENIDE SEMICONDUCTORS Ph.D. Thesis
Thomas Claude Arnoldussen 1973 218 p
Avail: Univ. Microfilms Order No. 74-6444

A model for photoconductivity in amorphous chalcogenides was developed by starting with traditional semiconductor recombination statistics and a generalized distribution of localized states within the mobility gap of an amorphous semiconductor. This model was applied to several complex chalcogenide alloys and to a pseudobinary arsenic triselenide-arsenic tritelluride alloy. It was found that the density of recombination centers near the band edges is about 10 to the 19th power per cubic centimeter per electron-volt within one- to two-tenths of an electron-volt from the mobility edge. Various electronic and optical properties of the bulk and thin film amorphous forms of the arsenic triselenide-arsenic tritelluride alloy were compared. It was found that the surface and the volume of the bulk material have essentially identical properties, and that the thin film properties are essentially the same as the bulk properties. Dissert. Abstr.

N74-21357 Texas Technological Univ., Lubbock.
ULTRASONIC ATTENUATION IN SUPERCONDUCTING CADMIUM Ph.D. Thesis
Roger Alan Robbins 1973 202 p
Avail. Univ. Microfilms Order No. 74-5824

Measurements were made of the attenuation of longitudinal sound waves as a function of temperature in normal and superconducting high purity crystalline cadmium. Ultrasonic frequencies between 10 MHz and 110 MHz were propagated in each of the three principle crystallographic directions. Data were taken with the aid of a single shot type He-3 refrigerator and a phase sensitive, continuous measuring electronic system, using the conventional single ended pulse-echo method. Supplementary magnetoacoustic measurements were made to determine the electron mean free path lengths in the cadmium sample. Magnetic susceptibility measurements were also performed to determine the magnetic impurity level. Analysis of the data indicates the presence of a single, frequency independent, superconducting energy gap associated with each crystallographic direction studied. Dissert. Abstr.

N74-21358 Illinois Univ., Urbana.
THEORY OF POINT-IMPERFECTION STATES IN SEMICONDUCTORS Ph.D. Thesis
Sokrates Theodore Pantelides 1973 190 p
Avail: Univ. Microfilms Order No. 74-5663

The Kohn-Luttinger effective mass theory (KL EMT) is re-examined using impurity potentials calculated from fundamental crystal and atomic properties. The theory is found valid for both shallow and deep levels but only when the impurity core has the same number of electrons as the core of the host atom. Excellent agreement with experiment is obtained for phosphorus and the deep sulfur levels in silicon which satisfy this condition. For these cases the impurity potentials do not have strong high Fourier components and the one-hand approximation yields the correct nodal structure for the impurity-electron wavefunction (r). Contrary to the traditional understanding of the EMT, the theory is found inapplicable for other shallow donors. Furthermore, the one-band approximation fails to give the correct nodal structure to the impurity-electron wavefunction in the central cell. In the second part, the general theory of pseudopotentials is coupled with the effective-mass theory to produce the pseudo EMT. Dissert. Abstr.

N74-21359*# College of William and Mary, Williamsburg, Va.
PRECISE MEASUREMENT OF CHARGED DEFECTS IN III-V COMPOUNDS (SUPPLEMENT 2) Final Report
J. F. Soest Nov. 1973 95 p refs
(Grant NGR-47-006-050)
(NASA-CR-138076) Avail: NTIS HC $7.75 CSCL 20L

Experimental methods and related theory which will permit the measurement of low concentrations of vacancies and other defects in III-V compound semiconductors are discussed. Once the nature of these defects has been determined, this information can be incorporated into a transport theory for devices constructed from these materials, and experiments conducted to test the theory. The vacancies and other defects in the III-V compounds are detected by measurement of the nuclear magnetic resonance (NMR) line width. Most of the III-V compounds have at least one isotope with a nuclear quadrupole moment. In a crystal with a cubic crystal field (characteristic of most III-V compounds) there is no quadrupole splitting of the Zeeman resonance line. However, a defect removes the cubic symmetry locally and causes splitting which result in a change of the NMR width. This change can be used to detect the presence of vacancies. Author

N74-21360# Joint Publications Research Service, Arlington, Va.
UBIQUITOUS SEMICONDUCTORS
O. Snitko 5 Apr. 1974 7 p Transl. into ENGLISH from Pod

Znamenen Leninizma (Kiev), no. 17, Sep. 1973 p 64-66
(JPRS-61684) Avail: NTIS HC $4.00

Data dealing with developments in solid state physics by the Institute of Semiconductors of the Ukrainian Academy of Sciences are reported. Author

N74-21361# National Bureau of Standards, Washington, D.C. Electronic Technology Div.
SEMICONDUCTOR MEASUREMENT TECHNOLOGY Quarterly Report, 1 Jul. - 30 Sep. 1973
W. Murray Bullis, ed. Mar. 1974 67 p refs Sponsored in part by Def. Nucl. Agency
(ARPA Order 2397)
(NBS-SP-400-1; LC-74-600040) Avail: SOD HC $1.15 as C13.10:400-1

National Bureau of Standards activities directed toward the development of methods of measurement for semiconductor materials, process control, and devices are described. Principal accomplishments include; (1) extension if the technique for measuring thermally stimulated current and capacitance to include measurements on MOS capacitors, (2) completion of the development of the thermal response method for evaluation of transistor die attachment, (3) analysis of the interlaboratory comparison of transistor scattering parameter measurements, (4) preliminary review of measurement problems in the photolithographic aspects of semiconductor device processing, of problems associated with certain hermeticity testing procedures, and of methods for evaluating metallization step coverage, and (5) initiation of activity on the characterization of oxide films in MOS structures and analysis of diffusion profiles. Results are also reported on spreading resistance, capacitance-voltage, and sheet resistance measurements, the activation energy of the gold acceptor in silicon, evaluation of the base-to-metal contact resistor test structure, metallurgical systems for ultrasonic bonding, burn-out characteristics of fine gold and aluminum bonding wire, transistor thermal resistance measurements, and microwave diode conversion loss measurements. Author

N74-21362*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AUGER MEASUREMENTS ON T-027 SAMPLES EXPOSED DURING THE SKYLAB 2 MISSION
Palmer N. Peters Feb. 1974 57 p refs
(NASA-TM-X-64834) Avail: NTIS HC $6.00 CSCL 20L

Auger electron spectroscopy measurements performed on Skylab 2 indicate a low rate of deposition of permanent, continuous film contamination on nickel and gold surfaces positioned on the antisolar side of the spacecraft. These measurements and supportive evidence indicate that for the particular locations and orientations of these samples permanent films of less than 3 nm (30 A) thickness were deposited during an exposure of 40 hours at a temperature of approximately -32 C. Author

N74-21363# Newcastle-upon-Tyne Univ. (England). Dept. of Electrical and Electronic Engineering.
A STUDY OF THE SUITABILITY OF NEW SOLID-STATE DEVICES FOR SPACE APPLICATIONS
H. Hartnagel and I. Kuru Paris ESRO Nov. 1973 123 p refs
(Contract ESTEC-1170/70)
(ESRO-CR-69) Avail: NTIS HC $9.25

Numerous principles for generating microwave power are considered for space applications. More than fourteen well-demonstrated devices were reviewed. The main emphasis was devoted to devices capable of amplifying power efficiently at frequencies above 4 GHz. The physical principles were identified that limit further improvements in device performance. GaAs impatt devices are recommended, and as a longer-term development goal, the trapatt amplifier. Author (ESRO)

N74-21364# Institut fuer Festkoerpermechanik, Freiburg (West Germany).
PLASTIC DEFORMATION OF POTASSIUM CHLORIDE SINGLE CRYSTALS BY 5 MHz ULTRASONIC WAVES [PLASTISCHE DEFORMATION VON KC1-EINKRISTALLEN DURCH 5-MHz-ULTRASCHALLWELLEN]
Martin Schinker Apr. 1973 46 p refs In GERMAN; ENGLISH summary
(WB-2/73) Avail: NTIS HC $5.50

Long-range movement of Frank-Read generated dislocation loops, produced by intense longitudinal 5 MHz ultrasonic waves, was observed in potassium chloride single crystals by stress optical and etching techniques. Dislocation multiplication of individual dislocation sources along particular slip planes was noticed. Plastic deformation of KCl crystals by ultrasonic standing waves is explained by the movement and multiplication of dislocations in the antinodal planes in accord with models proposed by Frank-Read and Koehler-Orowan. Concentrations of edge dislocations were observed in the nodal planes of the ultrasonic wave in accordance with the low dislocation mobility at low shear-stress level. Author (ESRO)

N74-21365# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ROENTGENOLUMINESCENCE OF ALKALIHALIDE CRYSTALS ACTIVATED BY BIVALENT EUROPIUM
P. S. Ivakhnenko, E. I. Shuraleva, I. A. Parfyanovich, and A. I. Vilitkevich 8 Jan. 1974 11 p refs Transl. into ENGLISH from Radiats. Fiz. Nemetallicheskikh Kristallov, Sb, Statei (USSR), v. 3, no. 3 p 72-77
(AD-773505; FTD-HT-23-99-74) Avail: NTIS CSCL 20/12

The study of a number of alkalihalide crystals with an Eu(2+) additive disclosed that, despite one and the same activator, the mechanism of recombination luminescence has its own special features in various base materials. The authors proceeded with investigations along these lines using NaBr, NaI, and CsI crystals activated with Eu(2+); the specimens were grown from a melt with europium concentration in the melt of 0.01 and 0.1 wt. %. GRA

N74-21366# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELECTRICAL RESISTANCE OF RUBIDIUM AND POTASSIUM AT HELIUM TEMPERATURES
B. N. Aleksandrov, O. I. Lomonos, and Ye. D. Semenova 17 Jan. 1974 13 p refs Transl. into ENGLISH from Zh. Eksperim Teor. Fiz. (Moscow), v. 64, no. 2, 1973 p 576-581
(AD-773870; FTD-HT-23-752-74) Avail: NTIS CSCL 20/12

Electrical resistance of Rb and K was measured in the 1.6-5.1K range for samples of varying purity. GRA

N74-21367# Pennsylvania State Univ., University Park. Dept. of Physics.
VIBRATIONAL AND ELECTRONIC PROPERTIES OF SINGLE CRYSTAL SURFACES Final Report
T. E. Feuchtwang 10 Jul. 1973 15 p refs
(Grant AF-AFOSR-1727-69; AF Proj. 9761)
(AD-773462; AFOSR-73-1699TR) Avail: NTIS CSCL 20/12

Under the sponsorship of the grant, work was undertaken in the theory of (1) Field Emission, (2) Single Particle Tunneling in Thin Junctions, (3) Many-body Theory of Tunneling. In work on high field emission of electrons, it was demonstrated that one-dimensional analysis should only be considered as qualitative guides. A full three-dimensional analysis while much more difficult and time-consuming is probably necessary for a complete quantitative exploitation of experimental observation. A single particle theory of tunneling was developed by means of a generalization of the WKB approximation to potentials which asymptotically tend to a periodic rather than tot a constant function of position. A many particle theory of tunneling, avoiding the transfer Hamiltonian formalism, was developed. The theory clarifies the significance of the transfer Hamiltonian. It also differs in its detailed predictions from current formulations. Author (GRA)

N74-21368# Illinois Univ., Urbana. Solid State Electronics Lab.
STUDIES OF SILICON EXTRINSIC DETECTORS
C. T. Sah 28 Nov. 1973 41 p refs
(Contract F19628-72-C-0199; AF Proj. 5638)
(AD-773301; AFCRL-TR-73-0737; UILU-73-2562; Scientific-1) Avail: NTIS CSCL 20/12

Theoretical analyses of the effects of ion position correlation on the electron mobility in n-type silicon are compared with experiments. Steady-state and transient extrinsic photoconductivity are analyzed including the presence of recombination

centers. Theoretical analyses are made of the photoionization cross-section of impurity for Coulomb and spherical square wells and compared with experimental data of shallow acceptors in silicon. Author (GRA)

N74-21369# Texas Univ., Austin. Electronics Research Center.
A STUDY OF NUCLEATION AND DYNAMIC PHENOMENA OF THERMAL FILAMENTS IN VANADIUM DIOXIDE
W. H. Neal, III, R. M. Walser, and R. W. Bene 12 Sep. 1973 66 p refs
(Contract F44620-71-C-0091; AF Proj. 4751)
(AD-774528; TR-153; AFOSR-74-0148TR) Avail: NTIS CSCL 20/12

The switching event responsible for the breakdown of thin films of vanadium dioxide which leads to the production of thermal filaments was theoretically and experimentally studied. It was found that a critical-temperature mechanism associated with the vanadium dioxide transition temperature was responsible for the breakdown event. A scanning infrared microscope was used to examine the thermal filaments at various bias points and ambient temperatures. The filament width and peak temperature were found to be sensitive functions of these parameters. It was also found that thermal filaments could exist at temperatures very near ambient due to thermal hysteresis. (Modified author abstract) GRA

N74-21370# Perkin-Elmer Corp., Wilton, Conn.
MOLECULAR BEAM EPITAXY OF II-VI COMPOUND WAVEGUIDES Quarterly Technical Report, 1 Oct. - 31 Dec. 1973
Donald L. Smith 31 Dec. 1973 15 p refs
(Contract N00014-73-C-0280; ARPA Order 2327)
(AD-774126; PE-11821) Avail: NTIS CSCL 20/2

Semiconductor II-VI compound optical waveguide growth is being studied experimentally using molecular beam epitaxy, a closely-controlled form of vacuum evaporation, under ultra-high vacuum. The objective is to generate low-loss single-crystal guides suitable for constructing active elements in optical communications systems. Author (GRA)

N74-21371# Salford Univ. (England). Dept. of Electrical Engineering.
ION IMPLANTATION OF SEMICONDUCTORS, METALS AND ALLOYS Interim Report, 1 Sep. 1971 - 31 Aug. 1973
G. Carter and W. A. Grant 31 Aug. 1973 23 p refs
(Grant AF-AFOSR-2115-71; AF Proj. 9761)
(AD-774654; AFOSR-74-0104TR; IR-7) Avail: NTIS CSCL 20/12

The effect of heavy ion implantation of GaAs, GaP, CdS and Al2O3 has been investigated using electron microscopy and Rutherford backscattering based on channelling. The variation of damage with ion dose, the annealing behaviour of implanted material and the lattice location of the foreign implants have been investigated. Author (GRA)

N74-21372# Pennsylvania State Univ., University Park. Materials Research Lab.
SYNTHESIS AND CRYSTAL CHEMISTRY OF OXYSULFIDES WITH THE GARNET STRUCTURE
R. R. Neurgaonkar and William B. White Aug. 1973 34 p refs
(Contract F19628-71-C-0232; AF Proj. 5620)
(AD-774641; AFCRL-TR-73-0611; SR-4) Avail: NTIS CSCL 07/4

In a search for new ternary materials with potential suitability for 10.6 micrometer window applications, the sulfur analogs of the garnet structure were investigated. Pure sulfur end-member garnets cannot be synthesized under ambient pressures. A series of oxysulfide garnets with sulfur to oxygen ratios of 7.5/4.5 were discovered. These have the general formula (Ln3(VIII)Me2 (VI)Me3(IV)O4.5S7.5) where Ln is any rare earth except La(3+) and Me is a variety of 2+, 3+, and 4+ transition metal ions plus Mg(2+) and Ga(3+). A total of more than 40 compounds have been synthesized and are characterized by X-ray diffraction data. IR spectra of selected garnets indicate that the highest frequency transverse optic mode lies in the range of 470/cm. Complex spectra from two garnets indicate the possibility of anion ordering. (Modified author abstract) GRA

N74-21373# Cornell Univ., Ithaca, N.Y.
MAGNETIC ORDERING OF RARE EARTH IONS AT THE METAL-NONMETAL TRANSITION Final Report, 1 Feb. 1971 - 31 Dec. 1973
M. J. Sienko 31 Dec. 1973 16 p
(Grant AF-AFOSR-2040-71; AF Proj. 9764)
(AD-774635; AFOSR-74-0103TR) Avail: NTIS CSCL 20/12

The objective of this research is to investigate the nature and mechanism of magnetic ordering at the metal-nonmetal transition. The approach is to synthesize new compounds in which the concentration of magnetic ions or conduction-band electrons could be varied independently in the neighborhood of the metal-nonmetal transition and measure magnetic parameters as a function of compound stoichiometry. Three kinds of systems were investigated: hexaborides, tungsten bronzes, and metal-ammonia compounds. GRA

N74-21374# Stanford Univ., Calif. Electronics Labs.
A STUDY ON THE FUNDAMENTAL LIMITATION ON MAGNETIC DOMAIN WALL VELOCITIES Final Progress Report, 1 Mar. 1972 - 31 Dec. 1973
Robert L. White 15 Dec. 1973 32 p refs
(Grant AF-AFOSR-2260-72)
(AD-774634; AFOSR-74-0056TR) Avail: NTIS CSCL 20/12

The purpose of this study was to understand the mechanisms limiting magnetic domain wall velocity and magnetic domain wall mobility in low-loss materials such as the garnets and orthoferrites. In particular, clarification was sought of the role of the spin wave spectrum of the magnetic material in damping the inherently precessional phenomena involved in the domain wall motion. GRA

N74-21375# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
METAL-SEMICONDUCTOR JUNCTIONS ON CLEAVED CADMIUM SULFIDE Ph.D. Thesis
Charles E. Ehrenfried Dec. 1973 248 p refs
(AF Proj. 7371)
(AD-774439; DS/PH/73-4) Avail: NTIS CSCL 20/12

Diffused metal-semiconductor junctions were measured and compared to a theoretical model to obtain a better understanding of the barrier mechanisms after having first formed controlled Schottky barriers. Rectifying metal contacts of gold, silver and copper were deposited in situ on vacuum cleaved surfaces of conducting single crystal cadmium sulfide. The barrier parameters of the metal-semiconductor contact were determined from an analysis of differential capacitance and current-voltage experimental measurements. A theoretical model for a diffused metal-semiconductor barrier which included a semi-insulating layer and a linearly graded region was used to drive the capacitance-voltage relations. A parametric computer study of the model was done and the experimental data for several heat-treated barriers agreed favorably using this model. (Modified author abstract) GRA

N74-21376# Washington Univ., Seattle.
HIGH-FIELD TRANSPORT PROPERTIES AND ASSOCIATED ELECTROLUMINESCENCE Final Report, 17 Mar. 1970 - 15 Dec. 1973
S. S. Yee and M. L. Neudorfer 1974 9 p refs
(Grant DA-ARO(D)-31-124-70-G58;
DA-ARO(D)-31-124-71-G93)
(AD-774314; AROD-8391-6-E) Avail: NTIS CSCL 20/12

A study of the bulk acoustoelectric effect and associated electroluminescence in II-VI compound semiconductors is summarized. Correlations were made between sample resistivity profiles and current oscillations in semiconducting CdS. The acoustoelectric aftercurrent was investigated in photoconducting CdS. A nonlinear theory was developed which predicts electron current in the presence of acoustic energy and an electric field. Bursts of electroluminescence were observed to come from domains when excess voltage pulses were superimposed on the drive voltage in CdSe samples with acoustoelectric domains. Author (GRA)

N74-21377# California Univ., Los Angeles. Dept. of Physics.
DYNAMIC BEHAVIOR OF PARAMAGNETIC IONS AND CONDUCTION ELECTRONS IN INTERMETALLIC COMPOUNDS GdsubXLusub1-xAl2
C. Rettori, H. M. Kim, E. P. Chock, and D. Davidov (Hebrew Univ. Jerusalem) Feb. 1974 34 p refs Sponsored in part by NSF, Wash., D. C.
(Contract N00014-69-A-0200-4032)
(AD-774708) Avail: NTIS CSCL 20/12

Electron spin resonance of Gd in Gd(x)Lu(1-x)Al2 intermetallic compounds exhibit significant changes in the g shift and thermal broadening upon (a) varying the Gd concentration (b) adding second non-magnetic impurity, Th, and (c) varying the temperature. These behaviors indicate the presence of the bottleneck and dynamic effects in the relaxation mechanism. The results were analyzed using a recent band calculation. The q-dependence of the exchange interaction and the spin-flip scattering rates of the conduction electrons caused by the Gd and Th impurities were extracted. Data are compared with previous results on isoelectronic systems LaAl2 and YAl2 doped with the same impurities. Author (GRA)

N74-21378# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
SURFACE TEMPERATURE MEASUREMENTS FOR ION BOMBARDED Si AND GaAs AT 1.0 TO 2.0 MeV Physical Sciences Research Papers
L. F. Lowe, J. K. Kennedy, D. E. Davies, M. L. Deane, and L. J. Eyges 29 Oct. 1973 10 p refs
(AF Proj. 5621)
(AD-774401; AFCRL-PSRP-571; AFCRL-TR-73-0660) Avail: NTIS CSCL 20/12

The use of ion implantation both as a research tool and as an electronic device fabrication technique has increased significantly in recent years. One parameter of interest is the temperature produced by the bombarding ions in the implanted volume during the irradiation. An infrared detector was used to measure these temperatures for ion beams of N+, N2+, O+, O2+, C+, CO+, and H+ at energies from 1 - 2.0 MeV and currents up to 12 micro amperes/sq cm. Author (GRA)

N74-21379# California Univ., Los Angeles. Dept. of Physics.
DYNAMIC SUSCEPTIBILITY IN THE ANDERSON AND EXCHANGE MODELS. THE ADMIXTURE EFFECT
J. Zitkova-Wilcox Aug. 1973 14 p refs Prepared jointly with Tufts Univ., Medford, Mass.
(Contract N00014-69-A-0200-4032; Grant NSF GH-35689)
(AD-774079) Avail: NTIS CSCL 20/12

Spin transport equations derived in the Anderson model are presented. For g(e) not = to g(d) additional terms arise corresponding to the difference between the magnetizations transferred between the localized and conduction electrons by the admixture. The results differ from those of Sasada and Hasegawa and are shown to be compatible with the exchange model results. Author (GRA)

N74-21380# California Univ., Los Angeles. Dept. of Physics.
THERMODYNAMICS OF AN EXTENDED HUBBARD MODEL CHAIN. 1. ATOMIC LIMIT FOR THE HALF-FILLED BAND
G. Beni and P. Pincus Jul. 1973 34 p refs
(Contract N00014-69-A-0200-4032; Grant NSF GH-31973)
(AD-774078) Avail: NTIS CSCL 20/12

For an infinite linear chain the authors consider the atomic limit of an extended Hubbard model which takes into account the nearest neighbor interatomic electron-electro repulsion. The specific heat, static magnetic susceptibility, and density-density correlation function are studied exactly at any temperature for the half-filled band case. The authors discuss also the quarter-filled band in the limit of infinite intra-atomic Coulomb repulsion. Author (GRA)

N74-21381# California Univ., Los Angeles. Dept. of Physics.
CRYSTALLINE-FIELD EFFECTS IN THE EPR OF ER IN VARIOUS CUBIC METALS
C. Rettori, D. Davidov, and H. M. Kim Jul. 1973 16 p refs
(Contract N00014-69-A-0200-4032; Grant NSF GH-31973)
(AD-774090) Avail: NTIS CSCL 20/12

Electron spin resonance measurements on the dilute alloys Ag:Er, Au:Er, Rh:Er and Ir:Er exhibit a change in slope of the Er resonance thermal broadening above approximately 7 K. This behavior is interpreted in terms of off diagonal matrix elements of the exchange coupling between the Gamma 7 ground state and the Gamma 8 first excited state. Author (GRA)

N74-21382# Illinois Univ., Urbana. Coordinated Science Lab.
SUPERCONDUCTIVITY STUDIES IN POLYCRYSTALLINE LEAD TELLURIDE
David Richard Myers Sep. 1973 52 p refs
(Contract DAAB07-72-C-0259)
(AD-774378; R-624; UILU-ENG-73-2226) Avail: NTIS CSCL 20/12

The report reviews electromagnetic properties of superconductors, thermodynamics of the superconducting transition, and excitonic superconductivity. Sample preparation and results on superconductivity studies on lead telluride samples are discussed. GRA

N74-21383# Illinois Univ., Urbana. Coordinated Science Lab.
LUMINESCENCE IN ZINC SELENIDE WITH SODIUM AND ALUMINUM DOPING
Pallab Kumar Chatterjee Dec. 1973 58 p refs
(Contract DAAB07-72-C-0259)
(AD-774379; R-634; UILU-ENG-73-2238) Avail: NTIS CSCL 20/12

In the context of optical devices, the need for blue light emitting devices forms the basic motivation for the present study. The inherent luminescent efficiency of the II-VI compounds and their direct band gap make these materials a natural choice for this work. In the present work the author described a method of doping ZN Se with Na acceptors and Al donors. Photoluminescence data suggest that a strong blue band pair transition between Al-donors and Na-acceptors exists in Zn Se doped with these impurities. GRA

N74-21384# Stanford Univ., Calif. Electronics Labs.
FUNDAMENTAL INVESTIGATIONS OF AMORPHOUS SEMICONDUCTORS AND TRANSITION METAL OXIDES Final Report, 1 Jan. 1966 - 30 Sep. 1973
William E. Spicer 15 Jan. 1974 7 p refs
(Contract DA-31-124-ARO(D)-430)
(AD-774298; AROD-5890-20-P) Avail: NTIS CSCL 20/12

The density of states for amorphous Ge and Si has been obtained for the top 5 eV of the valence band and bottom 10 eV of the conduction band. These results have been confirmed by other measurements. This work has produced experimental evidence that the band edges in properly prepared amorphous Ge and Si are much sharper and the density of states in the band gap can be much lower than previously believed. Theoretical arguments have appeared which support these results. Criteria were developed for obtaining sharp band edges and minimizing the density of states in the bandgap. The result that band edges can be sharp in amorphous materials and that the density of states in the bandgap region can be reasonably low have great importance for the design and fabrication of amorphous devices. Experiments have been carried out with large amounts of As impurity in Ge. The results from ultraviolet photoemission studies on SrTiO3, TiO2 and VO2 are summarized in terms of the electronic structure of these materials. VO2 has been studied in both the metallic and semiconducting forms. Results have been obtained from a UV polarizer especially designed and constructed on this project. (Modified author abstract) GRA

N74-21385# California Univ., Los Angeles. Dept. of Physics.
CORRELATION BETWEEN ELECTRON SPIN RESONANCE AND SUPERCONDUCTIVITY IN Gd(x)B(1-x)Ru2 (B EQUALS Th, Ce, La)
D. Davidov, C. Rettori, K. Baberschke, E. P. Chock, and R. Orbach Aug. 1973 10 p refs Sponsored in part by NSF
(Contract N00014-69-A-0200-4032)
(AD-774073) Avail: NTIS CSCL 20/12

Correlation between EPR and superconductivity in Gd(x)B(1-x) Ru2 (B = Th, Ce, La) enables the interpretation of the behavior of the superconducting transition temperature as a function of Gd concentration in these cubic intermetallic compounds. Author (GRA)

N74-21386# New Mexico Univ., Albuquerque.
A RADIATION EFFECTS RESEARCH PROGRAM Final Report, 1 Sep. 1967 - 31 Aug. 1973
W. W. Grannemann, L. T. Boatwright, W. J. Byatt, R. A. Colclaser, and H. D. Southward Oct. 1973 76 p refs
(Contract N00014-68-A-0158)
(AD-774159; EE-219(73)ONR-005) Avail: NTIS CSCL 20/12

Radiation effects research at The University of New Mexico has been directed toward basic research objectives involving dielectric materials and semiconductor materials. Processing of dielectric materials and semiconductor materials has been related to radiation effects. Secondary objectives included radiation effects on solid-state devices and circuits. GRA

N74-21387# California Univ., Berkeley. Dept. of Physics.
NONEXISTENCE OF THE DIPOLE DRIVING MECHANISM IN THE dc FERROMAGNETIC HALL EFFECT
S. K. Lyo and T. Holstein Nov. 1973 14 p refs
(Contract N00014-69-A-0200-4032; Grant NSF GH-35689)
(AD-774661) Avail: NTIS CSCL 20/12

The authors show that the so-called dipole-driving mechanism for the dc ferromagnetic Hall current is nonexistent.
Author (GRA)

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N74-21388# Defence Research Information Centre, Orpington (England).
CONTRIBUTION TO THE GAS CHROMATOGRAPHIC ANALYSIS OF PROPELLANTS
A. Sopranetti and H. U. Reich May 1973 17 p refs Transl. into ENGLISH from Explosivstoffe (Mannheim), v. 20, no. 11/12, 1972 p 197-202
(DRIC-Trans-3201; BR30546) Avail: NTIS HC $4.00

A method is described for the quantitative determination by gas chromatography of nitroglycerin and other extractable components of propellants. Reproducibility and absolute accuracy were checked by thorough examination and the analytical versatility of the method was demonstrated. Packed columns were used for the separation by gas chromatography. A good selectivity with short retention times was achieved by low coating of the support with stationary phases that are adapted exactly in their polarity. In three examples, the quantitative determination is given of the following combined substances: nitroglycerin, diphenylamine, 2-nitro-diphenylamine, ethyl-centralite, triacetin, resorcin, methyl-phenyl-wrethan, 2-4-nitro-toluene, and dibutyl-phtalate. In all analyses, the standar deviations remain below 2.5%. Author (ESRO)

N74-21389# European Space Research Organization, Paris (France).
THE IGNITION CHARACTERISTICS OF HYPERGOLIC FUELS UNDER WATER
Werner Hartung, H. Koch et al Jan. 1974 38 p Transl. into ENGLISH of Zuendverhalten Hypergoler Treibstoffkombinationen unter Wasser, DLR-MITT-73-07, DFVLR, 1973
(ESRO-TT-12; DLR-MITT-73-07) Avail: NTIS HC $5.00; Ger. 9,5 DM

The influences of water depth, of the injector configuration and the salt concentration in the water were of special interest in these investigations. The results of nearly 1850 experiments are discussed. Author (ESRO)

N74-21390# Georgia Inst. of Tech., Atlanta.
COMPLEX METAL HYDRIDES. HIGH ENERGY FUEL COMPONENTS FOR SOLID PROPELLANT ROCKET MOTORS Annual Report, 1 Mar. - 31 Dec. 1973
Eugene C. Ashby 15 Feb. 1974 157 p refs
(Contract N00014-67-A-0519-0005; NR Proj. 093-050)
(AD-774129) Avail: NTIS CSCL 07/2

Several projects were pursued during the past nine months of this report period. The following projects were completed: (1) Diethyl ester soluble aluminum hydride, (2) Preparation of the first stable complex metal hydride of copper, LiCuH2, (3) Redistribution of aluminum hydride with groups I and II a and b metal halides; (4) Attempted desolvation of ether soluble aluminum hydride; Reactions of MZnx(CH3)2xH compounds with aluminum hydride. GRA

N74-21391# Esso Research and Engineering Co., Linden, N.J.
COMBUSTION AND HEAT RECOVERY OF AIR FORCE WASTE PETROLEUM OILS AND LUBRICANTS Final Report, Aug. - Dec. 1973
Martin Lieberman Feb. 1974 73 p refs
(Contract F29601-73-C-0101; AF Proj. 683M)
(AD-774563; AFWL-TR-73-244) Avail: NTIS CSCL 21/4

The primary objective of this study was to evaluate the technical feasibility of disposing of waste oils and contaminated fuels generated at Air Force bases by burning them with fuel oil and/or natural gas in a conventional boiler installation. Waste aviation piston-engine oil, synthetic turbine lubricant, hydraulic fluid, Stoddard solvent, crankcase oil, JP-4 jet fuel, and aviation gasoline were burned in No. 2, No. 6 fuel oils, and with natural gas carriers. The results of combustion tests, conducted for as long as 3 hours, indicated that the waste oils could be burned at as high as 5 percent by volume in the fuel oils without producing any significant air pollution or boiler corrosion problems. Each gallon of waste oil or contaminated fuel burned saves approximately a gallon of fuel oil. GRA

N74-21392# Defence Research Establishment Valcartier (Quebec).
MEASUREMENT OF THE EFFICIENCY OF SURFACE-ACTIVE AGENTS BY MECHANICAL SPECTROSCOPY
G. Perrault and G. Duchesne Nov. 1973 21 p refs In FRENCH; ENGLISH summary
(AD-774569; DREV-TN-2089/73) Avail: NTIS CSCL 21/9

An oscillatory viscoelastometer was used to compare the rheological behavior of three composite propellants at low temperatures near their glass transition point. The efficiency of two surface-active agents has been established; an aziridine polyester showed better adhesion properties between the oxidizer particles and the elastomeric binder than an amine polyester; moreover, the two products combine to show synergism. The dynamic mechanical properties results and their effect on the interpretation of the mechanism of action of both compounds are discussed. Author (GRA)

N74-21393# Defence Research Establishment Valcartier (Quebec).
SYNTHESIS AND EVALUATION OF TRIISOCYANATE POLYMERS IN PROPELLANT BINDERS AND SOLID PROPELLANTS
M. Tremblax and G. Perrault Dec. 1973 26 p refs in FRENCH; ENGLISH summary
(AD-774561; DREV-TN-2068/73) Avail: NTIS CSCL 21/9

Triisocyanates were isolated in two ways: first, by the reaction of an excess of diisocyanates on several triols, and secondly, by molecular distillation of commercial isocyanates. No improvement was observed in the mechanical properties of propellants or propellant binders made from these triisocyanates and hydroxyl-terminated polybutadienes compared to those made from mixtures of triols and diisocyanates. The mechanical properties of polybutadiene propellant binders are improved by the addition of small amounts of low molecular weight diols to hydroxyl-terminated polybutadienes (PBBO and R45M). There is a change in the mechanical properties of R45M and PBBO binders with the variation in the structure of isocyanates. Author (GRA)

N74-21473* California Univ., Berkeley. Space Sciences Lab.
THE RELATIONSHIP OF SOLAR FLARE ELECTRONS TO THE FLARE FLASH PHASE AND TYPE 3 RADIO BURSTS
R. P. Lin *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 439-449 refs (For availability see N74-21440 12-30)
(Contracts NAS5-11038; NAS9-10509; Grant NGL-05-003-017)
CSCL 03B

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magneto-hydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N74-21394*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ASSESSMENT OF AN ANALYTICAL PROCEDURE FOR PREDICTING SUPERSONIC EJECTOR NOZZLE PERFORMANCE

Bernhard H. Anderson Washington Apr. 1974 52 p refs

(NASA-TN-D-7601; E-7413) Avail: NTIS HC $3.75 CSCL 20D

The ability of analysis to predict ejector nozzle characteristics over a wide range of conditions and to study the relation between design parameters and performance is assessed. The analytical method investigated provided an accurate and economical method for predicting the performance of supersonic ejector nozzles. The factors which had the greatest influence over ejector nozzle behavior were those which influenced the initial expansion and recompression process. Author

N74-21395*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SELF-TEACHING DIGITAL-COMPUTER PROGRAM FOR FAIL-OPERATIONAL CONTROL OF A TURBOJET ENGINE IN A SEA-LEVEL TEST STAND

Robert E. Wallhagen and Dale J. Arpasi Washington Apr. 1974 32 p refs

(NASA-TM-X-3043; E-7761) Avail: NTIS HC $3.25 CSCL 21E

The design and evaluation are described of a digital turbojet engine control which is capable of sensing catastrophic failures in either the engine rotor speed or the compressor discharge static-pressure signal and is capable of switching control modes to maintain near normal operation. The control program was developed for and tested on a turbojet engine located in a sea-level test stand. The control program is also capable of acquiring all the data that are necessary for the fail-operational control to function. Author

N74-21396*# Naval Air Propulsion Test Center, Trenton, N.J. Propulsion Technology and Project Engineering Dept.

ROTOR BURST PROTECTION PROGRAM: STATISTICS ON AIRCRAFT GAS TURBINE ENGINE ROTOR FAILURES THAT OCCURRED IN US COMMERCIAL AVIATION DURING 1972

R. A. DeLucia and G. J. Mangano Mar. 1974 20 p

(NASA Order C-41581-B)

(NASA-CR-136900; NAPTC-PE-40) Avail: NTIS HC $4.00 CSCL 21E

Based on FAA data, results are presented that establish (1) the incidence of rotor failure, (2) the type of fragments generated, (3) whether or not these fragments were contained, (4) the causes of failure, (5) where in the engine failure occurred, (6) what engines were affected and (7) what flight conditions prevailed at failure. The rate of uncontained rotor burst was considered to be significantly high. Blade fragments were generated in 95% of the rotor bursts, 20% of which were uncontained. Although fewer disk and rim fragment bursts occurred, none were contained. Author

N74-21397*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

INCIDENCE LOSS FOR A CORE TURBINE ROTOR BLADE IN A TWO-DIMENSIONAL CASCADE

Roy G. Stabe and John F. Kline Washington Apr. 1974 13 p refs

(NASA-TM-X-3047; E-7835) Avail: NTIS HC $3.00 CSCL 21E

The effect of incidence angle on the aerodynamic performance of an uncooled core turbine rotor blade was investigated experimentally in a two-dimensional cascade. The cascade test covered a range of incidence angles from minus 15 deg to 15 deg in 5-degree increments and a range of pressure ratios corresponding to ideal exit critical velocity ratios of 0.6 to 0.95. The principal measurements were blade-surface static pressures and cross-channel surveys of exit total pressure, static pressure, and flow angle. The results of the investigation include blade-surface velocity distribution and overall performance in terms of weight flow and loss for the range of incidence angles and exit velocity ratios investigated. The measured losses are also compared with two common methods of predicting incidence loss. Author

N74-21398*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

FREQUENCY RESPONSE OF AN AXIAL-FLOW COMPRESSOR EXPOSED TO INLET PRESSURE PERTURBATIONS

Edward J. Milner, Leon M. Wenzel, and Francis J. Paulovich Washington Apr. 1974 42 p refs

(NASA-TM-X-3012; E-7709) Avail: NTIS HC $3.25 CSCL 21E

Experimental results of a series of engine tests designed to obtain the stage dynamics of an eight-stage axial-flow compressor over the frequency range of 0.5 to 200 hertz are presented. The total pressure at the compressor face was varied by means of a secondary air jet system installed in the engine inlet and positioned to oppose the primary airflow. Total-pressure probes located at each compressor stage were used to obtain the frequency response of each compressor-stage total pressure to the average compressor-inlet total pressure. The engine operating conditions were chosen to illustrate the effects of changing the rotor speed, changing the exhaust nozzle area, and isolating the compressor discharge pressure perturbations from the fuel control and hence, the fuel flow. Author

N74-21399*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THE EXPERIMENTAL CLEAN COMBUSTOR PROGRAM: DESCRIPTION AND STATUS

Richard W. Niedzwiecki and Robert E. Jones 1974 16 p refs Presented at the Air Transport Meeting, Dallas, 30 Apr. - 2 May 1974; Sponsored by SAE

(NASA-TM-X-71547; E-7956) Avail: NTIS HC $4.00 CSCL 21E

The objectives, program plan, schedule, pollution and performance goals, program approaches to pollution reduction, and status of the project are presented. Advanced supersonic transport and combustion noise programs are also discussed. The phases of the program consist of the following: (1) screening of low pollutant combustors, (2) refinement of the best combustors, and (3) engine demonstration of the best combustors. It is stated that all combustor designs investigated appear capable of achieving the idle pollutant goals with additional development effort. Author

N74-21400# Royal Aircraft Establishment, Farnborough (England).

MEASUREMENTS OF THE THRUST AND EXHAUST CHARACTERISTICS OF A PULSED RAIL THRUSTER USING MERCURY PROPELLANT

B. C. Barber and D. G. Fearn Aug. 1973 24 p refs

(RAE-TR-73103; BR36638) Avail: NTIS HC $4.25

Measurements are reported on the thrust and exhaust characteristics of a pulsed plasma rail thrustor energized by a 1.0 of 1.3 micro F capacitor charged up to 4.5 kV. This device, intended for satellite attitude control, uses mercury propellant injected by an auxiliary discharge between a trigger pin and a small mercury pool. Measurements, using a beam type thrust balance, indicate that the thrust at 20 pulses/second rises from 5 dynes at 2 kV to 90 dyes at 4.5 kV. Plasma velocities derived from Langmuir probe data are in agreement with those deduced from image converter photographs of the acceleration process, but the detailed structure expected in the exhaust from these photographs is not detected by the probe. These velocities, when combined with values of momentum transfer, suggest that the ejected plasma has a mass of 0.04 micro g at 2 kV and 0.03 micro g at 4.5 kV. The corresponding thrustor efficients are 3% and 25%. While the mass values are consistent with the mass of the ionized exhaust as derived from the probe measurements

and with the mass of propellant injected by the trigger discharge, the total amount of mercury utilized in each discharge is greater. Author (ESRO)

N74-21401# Air Force Rocket Propulsion Lab., Edwards AFB, Calif.
SOLID STRAND BURN RATE TECHNIQUE FOR PREDICTING FULL-SCALE MOTOR PERFORMANCE Final Report, 1 Oct. 1972 - 30 Jul. 1973
James L. Koury Oct. 1973 40 p
(AF Proj. 305908MB)
(AD-773433; AFRPL-TR-73-49) Avail: NTIS CSCL 21/9

The objective of this program was to perform and evaluate solid strand burn rate measurements on the Titan 3 propellant taken from cartons which were cast during motor manufacture. The results of this evaluation would determine if the solid strand burn rate technique would be an acceptable approach toward re-establishing the correlation between full-scale motor performance, and small ballistic test motors, and liquid strand burn rate tests. The effects of strand preparation, sample selection, burn rate variability within the carton, and particle orientation were briefly investigated. During the program, an improved monitoring system was developed and demonstrated. GRA

N74-21402# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FEATURES IN THE TRANSIENT CHARACTERISTICS OF MIXED AND UNMIXED TYPE TURBOFANS
F. Fett 19 Dec. 1973 22 p refs Transl. into ENGLISH from Z. Flugwiss. (Brunswick), v. 20, no. 1/2, Jan./Feb. 1972 p 1-8
(AD-774411; FTD-HC-23-479-74) Avail: NTIS CSCL 21/5

Mixed and unmixed type turbofans, having identical rotating components and thermodynamic cycles, are compared in terms of transient characteristics and steady-state off-design operation. Effects of step changes in fuel flow rate, nozzle area, inlet pressure, ambient temperature and air bleed are illustrated on both the fan and compressor operating maps. Results show significant differences in the dynamic behavior of the mixed and unmixed turbofan engines without the influence of an engine control. (Modified author abstract) GRA

N74-21403# General Motors Corp., Indianapolis, Ind. Detroit Diesel Allison Div.
TEST OF SUPERSONIC COMPRESSOR CASCADE WITH SPLITTER VANES AND VORTEX GENERATORS ON BLADES Final Report, Jul. 1972 - Apr. 1973
Robert L. Holtman, Robert B. McClure, and George T. Sinnet Nov. 1973 430 p refs
(Contract F33615-71-C-1766; AF Proj. 7065)
(AD-774454; ARL-73-0141) Avail: NTIS CSCL 21/5

The report describes experimental research conducted with a linear, stationary, supersonic compressor cascade with blades of constant spanwise geometry and contoured sidewalls. The cascade incorporated splitter vanes midway between blades in the latter half of each blade passage. The influence of splitter vane orientation was investigated. The investigation covered a range of Mach numbers from 1.40 to 1.50 and a range of static pressure ratios. This report describes work accomplished with vortex generators mounted on the suction surfaces of the blades. (Modified author abstract) GRA

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear.

N74-21404 Michigan Univ., Ann Arbor.
AN INVESTIGATION INTO THE GEOCORONAL AND INTERPLANETARY HYDROGEN BALMER EMISSIONS Ph.D. Thesis
Sushil Kumar Atreya 1973 209 p
Avail: Univ. Microfilms Order No. 74-3572

The Doppler profile measurement of the geocoronal Balmer Alpha line were studied. The most controversial of the extraterrestrial sources, the interplanetary hydrogen was also investigated theoretically to predict its Balmer emission rates and Doppler profiles. Calculations indicate a maximum interplanetary Balmer Alpha intensity of the order of 0.06 to 0.1 Rayleighs, with perhaps a factor of two uncertainty in this estimate. In the process of making the geocoronal hydrogen Balmer Alpha measurements, some interesting regions of the Galaxy were also looked at for the Doppler profile of the Balmer Alpha emission originating there. Dissert. Abstr.

N74-21405*# Stanford Univ., Calif. Inst. for Plasma Research.
A MODEL COMBINING THE POLAR AND THE SECTOR STRUCTURED SOLAR MAGNETIC FIELDS
Leif Svalgaard, John M. Wilcox, and Thomas L. Duvall Jan. 1974 34 p refs
(Grant NGR-05-020-559; Contract N00014-67-A-0112-0068; Grant NSF GA-31138; NR Proj. 323-003)
(NASA-CR-137406; SU-IPR-557) Avail: NTIS HC $4.75 CSCL 03B

A phenomenological model of the interplay between the polar magnetic fields of the sun and the solar sector structure is discussed. The solar sector boundary is tilted with respect to central meridian, and boundaries with opposite polarity change are oppositely tilted. The tilt of a given type of boundary ((+,-) or (-,+)) changes systematically during the sunspot cycle as the polarity of the polar fields reverses. If we consider (1) a sunspot cycle where the northern polar field is inward (-) during the early part of the cycle and (2) a (+,-) sector boundary at central meridian, then the model predicts the following pattern: a streamer at high northern latitudes should be observed over the west limb together with a corresponding southern streamer over the east limb. The current sheet runs now NW-SE. At sunspot maximum the boundary is more in the N-S direction; later when the polar fields have completed their reversal the boundary runs NE-SW and the northern streamer should be observed over the east limb and the southern streamer over the west limb. Author

N74-21406*# Stanford Univ., Calif. Inst. for Plasma Research.
ANOMALOUS COSMIC-RAY ANISOTROPY AND UNIDIRECTIONAL INTERPLANETARY MAGNETIC FIELD DURING 1954
Ester Antonucci Sep. 1973 20 p refs
(Grant NGR-05-020-559; Contract N00014-67-A-0112-0068; Grant NSF GA-31138)
(NASA-CR-137417; SU-IPR-542) Avail: NTIS HC $4.00 CSCL 03B

Observations of the interplanetary magnetic field during solar minimum lead to the following important conclusions for cosmic ray modulation: the interplanetary magnetic field does not show any sector structure for a few solar rotations, and cosmic ray diffusion in the interplanetary medium is essentially anisotropic for rigidity. If diffusion occurs essentially along the magnetic field lines, the cosmic ray density U(r, T) is a summetric function of the heliolatitude lambda with a minimum in the equatorial plane. Therefore a cosmic ray density gradient across the solar equatorial plane exists and it depends on the size of the modulation region. Only if an unidirectional magnetic field is present and if the earth is outside the symmetry plane of the density function, i.e. the solar equatorial plane, the gradient is detected, over a long-term period, as a diurnal variation, with the direction of the maximum perpendicular to the interplanetary magnetic field. Author

N74-21407*# Stanford Univ., Calif. Inst. for Plasma Research.
GREEN CORONA AND SOLAR SECTOR STRUCTURE
Ester Antonucci and Leif Svalgaard Feb. 1974 16 p refs Submitted for publication
(Grant NGR-05-020-559; Contract N00014-67-A-0112-0068; Grant NSF GA-31138; NR Proj. 323-003)
(NASA-CR-137407; SU-IPR-561) Avail: NTIS HC $4.00 CSCL 03B

Analysis of the green line corona is presented for the interval 1947-1970 which suggests the existence of large-scale organization of the emission. The green line emission at high northern

latitudes (approximately 40 - 60 deg) is correlated with the emission at high southern latitudes 6, 15 and 24 days later, while the low latitude green corona seems to be correlated on both sides of the equator with no time lag. These coronal features are recurrent with a 27 day period at all latitudes between + or - 60 deg, and these large-scale structures are associated with the solar magnetic sector structure. The high correlation between northern and southern high-latitude emission at 15 days time lag is explained as a signature of a a two-sector structure, while four sectors are associated with the 6 and 24 day peaks.
Author

N74-21408# Lockheed Missiles and Space Co., Palo Alto, Calif.
INVESTIGATION OF THE SUN'S SPECTRUM IN THE 1.8 - 20 A RANGE FROM MEASUREMENT DATA ON THE INTERKOSMOS-4 AND THE VERTIKAL-1 AND VERTIKAL-2
B. N. Vasilev, Iu. I. Grineva, I. A. Zhitnik, V. I. Karev, V. V. Korneev, V. V. Krutov, and S. L. Mandelshtam [1973] 8 p refs Transl. into ENGLISH from Solnechno-Zemnaia Fiz. (USSR), no. 3, 1972 p 3-14
Avail: NTIS HC $4.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

By using the apparatus mounted on the Interkosmos-4 satellite and the Vertikal'-1 and Vertikal'-2 rockets, the soft solar X-radiation is investigated in the 1.8 to 20 A range. Solar flare spectra are obtained in two bands: 1.850 to 1.870 and 8.42 A with a 0.0004 A and 0.002 A resolution, respectively. Fourteen lines of the Fe 23 - Fe 25 ions are identified in the the former, and the doublet of the hydrogenlike ion Mg 11 is resolved for the first time in the latter. To explain the line shapes in the spectrum of highly-ionized iron, a model is proposed of a solar flare consisting of three radiating centers with a different temperature and moving at velocities approximately + or - 90 km/sec along the line of sight. The electron and ion temperatures and the emission measures for the active and flare domains are determined.
Author

N74-21409# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE SPECTRAL FLUXES OF SOLAR RADIATION PENETRATING THE OCEAN
A. A. Pivovarov and E. P. Anisimova [1973] 6 p refs Transl. into ENGLISH from Vestn. Mosk. Univ., Fiz., Astron. (Moscow), no. 6, 1973 p 649-654
Avail: NTIS HC $4.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Results of an experimental determination of the magnitudes of the total and spectral solar radiation fluxes penetrating to different depths in the ocean are presented. The magnitudes of the relative spectral fluxes at different depths in the ocean and the values of the volume attenuation coefficients of the total flux and the appropriate portions of the solar radiation spectrum are determined. Data are presented on the changes in spectral composition of the solar radiation penetrating under the sea surface with depth.
Author

N74-21410*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SWEET'S MECHANISM IN THE SOLAR WIND
L. F. Burlaga and J. D. Scudder Apr. 1974 15 p refs Submitted for publication
(NASA-TM-X-70630; X-692-74-110) Avail: NTIS HC $4.00 CSCL 03B

Sweet's mechanism occurs in the solar wind, at D-sheets near 1 AU. Conductivities on the order of 10,000 esu are obtained, which is on the order of the local plasma frequency. This implies that the effective collision frequency is on the order of the plasma frequency. The lateral extent of D-sheets is approximately 0.01 AU to 0.001 AU. Hundreds of such D-sheets are probably present between the orbits of Venus and Earth at any instant.
Author

N74-21411*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A STUDY OF THE SOLAR WIND ANGULAR MOMENTUM INCLUDING PROTON THERMAL ANISOTROPY Ph.D. Thesis - Catholic Univ. of Am., 1973
Mario H. Acuna Feb. 1974 198 p refs Submitted for publication
(NASA-TM-X-70621; X-692-74-52) Avail: NTIS HC $13.00 CSCL 03B

The solution to the steady state magnetohydrodynamic equations governing the supersonic expansion of the solar corona into interplanetary space is obtained for various assumptions regarding the form in which proton thermal energy is carried away from the sun. The one-fluid, inviscid, formulation of the MHD equations is considered assuming that thermal energy is carried away by conduction from a heat source located at the base of the corona. Angular motion of the solar wind led to the existence of three critical points through which the numerical solutions must pass to extend from the sun's surface to large heliocentric distances. The results show that the amount of magnetic field energy converted into kinetic energy in the solar wind is only a small fraction of the total expansion energy flux and has little effect upon the final radial expansion velocity.
Author

N74-21412*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CHARGE COMPOSITION OF HIGH ENERGY HEAVY PRIMARY COSMIC RAY NUCLEI Ph.D. Thesis - Catholic Univ. of Am.
Robert D. Price Mar. 1974 175 p refs
(NASA-TM-X-70622; X-661-74-71) Avail: NTIS HC $11.75 CSCL 03B

A detailed study of the charge composition of primary cosmic radiation for about 5000 charged nuclei from neon to iron with energies greater than 1.16 GeV/nucleon is presented. Values are obtained after corrections were made for detector dependences, atmospheric attenuation, and solar modulation. New values of 38.5, 32.4, 23.7, and 16.8 g/sq cm for the attenuation mean free paths in air for the same charge groups are presented.
Author

N74-21413*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
H-2, H-3, He-3 PRODUCTION IN SOLAR FLARES
R. Ramaty and B. Kozlovsky Apr. 1974 39 p refs Submitted for publication
(NASA-TM-X-70627; X-660-74-94) Avail: NTIS HC $5.00 CSCL 03B

The production of deuterium, tritium, and helium-3 from nuclear reactions of accelerated charged particles is evaluated with the ambient solar atmosphere. Updated cross sections and kinematics are used, calculations are extended to very low energies (approximates 0.1 MeV/nucleon), and the angular distribution of the secondary particles is calculated. The calculations are compared with data on accelerated isotopes from solar flares. In particular, the August 1972 events are considered for which both He-3 and nuclear gamma rays were observed. An explanation for He-3-rich events is provided in terms of the angular distributions of secondary isotopes, and the flux of 2.2 MeV gamma rays from such flares are also predicted.
Author

N74-21414# Lockheed Missiles and Space Co., Palo Alto, Calif.
ANGULAR DISTRIBUTION OF EARTH'S INFRARED RADIATION IN SPACE NEAR THE HORIZON
Iu. G. Andrianov, I. I. Karavaev, Iu. P. Safronov, and V. I. Tulupov [1973] 7 p refs Transl. into ENGLISH from the book "Infrakrasnye Spektry Izlucheniia Zemli v Kosmos", Moscow, Sov. Radio, 1973 p 69-76
Avail: NTIS HC $4.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Measurement of the angular distribution of the earth's intrinsic radiation by various spectrum bands using rockets and satellites is discussed. Methods for conducting the observations and the equipment used in artificial satellites are described. Typical recordings of a complete spectrophotometer cycle taken in space at various slant ranges from the horizon are presented. Values of the root mean square deviation from the mean, due to the spread in the ordinates of individual spectra of a given group are plotted. The change in the magnitude of the departing radiation as the sighting angle varies for certain wavelengths is illustrated.
Author

N74-21415# Explosives Research and Development Establishment, Waltham Abbey (England).
CONTINUOUS WORLD WIDE UV MONITORING PROGRAMME
A. Davis, D. Gordon, and G. V. Howell Jul. 1973 45 p refs (ERDE-TR-141; BR38187) Avail: NTIS HC $5.25

A simple method of continuously monitoring solar UV radiation is described. The method is based on exposing a polymer film which darkens in proportion to the dose of incident UV radiation it receives. The method is being used to continuously monitor UV radiation at 20 sites representative of the world's climates. Results of many of these sites for 1972 are given.
Author (ESRO)

N74-21416# Aerospace Corp., El Segundo, Calif.
RELATIVE CORONAL ABUNDANCES DERIVED FROM X-RAY OBSERVATIONS OF SODIUM, MAGNESIUM, ALUMINUM, SILICON, SULFUR, AND ARGON Technical Report, Jul. 1969 - Jul. 1973
Arthur B. C. Walker, Jr. 21 Nov. 1973 59 p refs
(Contract F04701-73-C-0074)
(AD-772710; TR-0074(9260-02)-2; SAMSO-TR-73-398) Avail: NTIS CSCL 03/2

The authors observed the coronal spectrum between 3.5 and 8.5 A and several levels of coronal activity, and determined absolute fluxes for 79 lines and for the continuum. Identifications have been determined for the majority of the lines observed, and in particular for the resonance lines of Mg XI, Mg XII, Al XII, Al XIII, Si XIII, Si XIV, S XV and S XVI. The measured fluxes of these lines have been used to construct a model of the temperature dependence of the coronal emission measure between 1.5 and 10 x 10 to the 6th power K. This model is used to determine the relative abundances of Mg, Al, Si, and S. The relative abundances of Ar and Na were also computed, using the observed intensities of weak lines of these two elements. (Modified author abstract) GRA

N74-21417# New Hampshire Univ., Durham. Dept. of Physics.
INFLUENCE OF CORONAL AND INTERPLANETARY PHENOMENA ON LOW ENERGY SOLAR CHARGED PARTICLE EVENTS
Robert E. Gold, Donald G. Mitchell, Jerome T. Nolte, Rudeger Reinhard, and Edmond C. Roelof 1 Oct. 1973 117 p refs
(Contract F19628-73-C-0070; AF Proj. 8600)
(AD-772734; SR-1; AFCRL-TR-73-0659) Avail: NTIS CSCL 03/2

Low energy solar charged particles (LESP) and interplanetary plasma and magnetic field observations during 1967 have been analyzed and the results have been related to solar coronal structure. The coronal connection longitude was calculated assuming instantaneous Archemides spirals, and the injection profile was compared with coronal natural line structure inferred from H alpha synoptic charts. It was found that LESP (0.3-100 MeV) undergo organized transport in the solar corona and collimated convection in interplanetary space. LESP tend to be confined to coronal magnetic polarity cells although the release cell may not be associated with the active region in which the LESP were accelerated. Evidence supporting extended acceleration of LESP has been found in several events. Author (GRA)

N74-21441* Stanford Univ., Calif.
MASS MOTION IN SOLAR FLARES
P. A. Sturrock *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 3-11 refs (For availability see N74-21440 12-30)
(Grants NGR-05-020-272; NGR-05-020-512)
CSCL 03B

N74-21442* Imperial Coll. of Science and Technology, London (England).
ENERGETIC PARTICLES AS A SOURCE OF FLARE ENERGY
H. Elliot *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 12-18 refs (For availability see N74-21440 12-30)
CSCL 03B

N74-21443* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR FLARE OBSERVATIONS AND SOLAR FLARE MODELS
Charles L. Hyder *In its* High Energy Phenomena on the Sun 1973 p 19-25 refs (For availability see N74-21440 12-30)
CSCL 03B

N74-21445* California Univ., Berkeley. Space Sciences Lab.
CHARACTERISTICS OF NONTHERMAL ELECTRONS ACCELERATED DURING THE FLASH PHASE OF SMALL SOLAR FLARES
S. R. Kane *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 55-77 refs (For availability see N74-21440 12-30)
(Contract NAS5-9094; Grant NGL-05-003-017)
CSCL 03B

N74-21452* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OBSERVATION OF MeV GAMMA-RAY EVENTS DURING MAY 1967 FROM ERS-18
D. E. Gruber (Calif. Univ., San Diego) and L. E. Peterson (Calif. Univ., San Diego) *In its* High Energy Phenomena on the Sun 1973 p 147-161 refs (For availability see N74-21440 12-30)
(Contract F04701-68-C-0108)
CSCL 03B

N74-21454* Tokyo Univ. (Japan). Dept of Astronomy.
THEORY OF MICROWAVE AND X-RAY EMISSION
Tatsuo Takakura *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 179-187 refs (For availability see N74-21440 12-30)
CSCL 03B

N74-21455* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THEORY OF SOLAR MICROWAVE BURSTS
R. Ramaty *In its* High Energy Phenomena on the Sun 1973 p 188-197 refs (For availability see N74-21440 12-30)
CSCL 03B

N74-21457* California Univ., San Diego. Dept. of Physics.
NONTHERMAL X-RAYS AND RELATED PROCESSES
H. S. Hudson *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 207-220 refs (For availability see N74-21440 12-30)
(Contract NAS8-28015)
CSCL 03B

N74-21458* Hale Observatories, Pasadena, Calif.
OPTICAL, HARD X-RAY, AND MICROWAVE EMISSION DURING THE IMPULSIVE PHASE OF FLARES
Joan A. Vorpahl *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 221-227 refs (For availability see N74-21440 12-30)
(Contract NAS5-9094; Grants NGL-05-003-017; NGL-05-002-034; NSF GA-31587)
CSCL 03B

N74-21459* Harvard Coll. Observatory, Cambridge, Mass.
THE EXTREME ULTRAVIOLET SPECTRUM OF SOLAR FLARES
Robert W. Noyes *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 231-241 refs Prepared in cooperation with Smithsonian Astrophysical Observatory (For availability see N74-21440 12-30)
(Contract NAS5-9274)
CSCL 03B

N74-21461* Naval Research Lab., Washington, D.C. E. O. Hulbert Center for Space Research.
SOFT X-RAY FLARE SPECTRA
G. A. Doschek and J. F. Meekins *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 262-275 refs (For availability see N74-21440 12-30)
CSCL 03B

N74-21462* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FURTHER RESULTS ON COOLING MECHANISMS FOR SOFT X-RAY FLARES
I. J. D. Craig (Univ. Coll., London), J. L. Culhane (Univ. Coll., London), K. J. H. Phillips, and J. F. Vesecky (Leicester Univ.) *In its* High Energy phenomena on the Sun 1973 p 276-282 refs (For availability see N74-21440 12-30)
CSCL 03B

N74-21463* New Hampshire Univ., Durham.
SOLAR GAMMA RAY AND NEUTRON OBSERVATIONS
E. L. Chupp (Max Planck Inst. for Physics and Astrophysics), D. J. Forrest, and A. N. Suri *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 283-300 refs (For availability see N74-21440 12-30)
(Contract NAS5-11054; Grant NGL-30-002-021)
CSCL 03B

N74-21464* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NUCLEAR GAMMA RAYS FROM SOLAR FLARES
R. Ramaty and R. E. Lingenfelter (Calif. Univ., Los Angeles) *In its* High Energy Phenomena on the Sun 1973 p 301-314 refs (For availability see N74-21440 12-30)
CSCL 03B

N74-21471* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MODULATION OF SOLAR COSMIC RAYS
L. A. Fisk *In its* High Energy Phenomena on the Sun 1973 p 418-438 refs (For availability see N74-21440 12-30)
CSCL 03B

N74-21479* Michigan Univ., Ann Arbor.
DECAY TIME OF TYPE 3 SOLAR BURSTS
Hector Alvarez and F. T. Haddock *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 537-539 refs (For availability see N74-21440 12-30)
CSCL 03B

N74-21480* Maryland Univ., College Park. Clark Lake Radio Observatory.
ON THE DENSITY OF THE CORONA IN REGIONS OF TYPE 3 ACTIVITY
T. B. H. Kuiper *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 540-551 refs (For availability see N74-21440 12-30)
(Grants NGR-21-002-029; NSF GP-19401)
CSCL 03B

N74-21481* Martin Marietta Corp., Denver, Colo.
A STORM OF TYPE 3 BURSTS OBSERVED BY RAE-1 IN AUGUST 1968
Edward G. Howard *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 552-557 refs (For availability see N74-21440 12-30)
CSCL 03B

N74-21482* High Altitude Observatory, Boulder, Colo.
TYPE 2 AND TYPE 3 BURST THEORY
Dean F. Smith *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 558-572 refs (For availability see N74-21440 12-30)
CSCL 03B

N74-21483* Tokyo Univ. (Japan). Dept. of Astronomy.
TIME PROFILE OF TYPE 3 BURSTS IN DECAMETER AND HECTOMETER RANGE
Tatsuo Takakura, Yoshiharu Naito, and Kenichiro Ohki (Tokyo Astron. Obs.) *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 573-576 (For availability see N74-21440 12-30)
CSCL 03B

N74-21484* High Altitude Observatory, Boulder, Colo.
FLARE-INDUCED MHD DISTURBANCES IN THE CORONA - MORETON WAVES AND TYPE 2 SHOCKS
Yutaka Uchida (Tokyo Astron. Obs.) *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 577-588 refs (For availability see N74-21440 12-30)
CSCL 03B

N74-21485* Commonwealth Scientific and Industrial Research Organization, Sydney (Australia). Div. Of Radiophysics.
REGULAR PULSATIONS FROM THE SOLAR CORONA
J. P. Wild *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 589-593 refs (For availability see N74-21440 12-30)
CSCL 03B

N74-21489* Commissariat a l'Energie Atomique, Saclay (France). Service d'Electronique Physique.
THE CHROMOSPHERIC ASSOCIATION OF THE METRIC TYPE 3 BURSTS - IMPLICATIONS CONCERNING THE ACCELERATION OF SOLAR ELECTRONS AND THE ACTIVE STREAMERS
F. Axisa, M. J. Martres (Obs. de Paris-Meudon), M. Pick (Obs. de Paris-Meudon), and I. Soru-Escaut (Obs. de Paris-Meudon) *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 615-622 refs (For availability see N74-21440 12-30)
CSCL 03B

N74-21490* Colorado Univ., Boulder. Dept. of Astro-Geophysics.
HIGH ENERGY PHENOMENA ON THE SUN SYMPOSIUM - SUMMARY AND OUTLOOK
James W. Warwick *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 625-630 (For availability see N74-21440 12-30)
CSCL 03B

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N74-21418 Houston Univ., Tex.
INTERIOR STRUCTURE OF ROTATIONALLY AND TIDALLY DISTORTED STARS Ph.D. Thesis
Robert Howard Wolfe, Jr. 1973 222 p
Avail: Univ. Microfilms Order No. 74-2838

A method for determining the interior equilibrium structure of a non-spherical star is derived for uniformly rotating and tidally distorted stars. The vector differential equations governing the interior structure are reduced to a form identical with the standard equations of a spherical star, except for the presence of two dimensionless form factors representing the effects of distortion. One factor accounts for the buoyancy of centrifugal force and is evaluated exactly. The other factor expresses the effect of the non-spherical stellar shape, and it is shown that the factor can be determined very accurately, even if the stellar shape is known only approximately. With these factors determined, the problem of constructing the distorted model is identical to that for the spherical model, and computational schemes developed for spherical stars are applicable to distorted stars as well.
Dissert. Abstr.

N74-21419 Texas Univ., Austin.
NUMERICAL SOLUTIONS TO INTERPLANETARY TRAJECTORY PROBLEMS INVOLVING CLOSE PLANETARY APPROACHES Ph.D. Thesis
Kenneth Ray Hall 1973 84 p
Avail: Univ. Microfilms Order No. 74-5246

The numerical solutions to interplanetary trajectory problems involving close planetary approaches are obtained in two steps. A series of two point boundary value problems are solved to provide a discontinuous trajectory from the initial point to the final point with the discontinuities occurring at the flyby times. The method of multiple shooting is then employed to produce a continuous trajectory which satisfies the boundary conditions of

the particular problem. Examples are provided which illustrate the application of this technique to the solution of an Earth-Venus two point boundary value problem and to an Earth-Venus-perihelion three point boundary value problem. Dissert. Abstr.

N74-21420 Stanford Univ., Calif.
THE MAGNETOSPHERIC STRUCTURE OF PULSARS Ph.D. Thesis
David Hall Roberts 1973 127 p
Avail: Univ. Microfilms Order No. 74-6535

A model of pulsar magnetospheres where the radiation is produced near the surface of a neutron star is described. The relationship between the braking index and the period pulse width distribution of pulsars is established. Observations concerning timing irregularities and the dispersion measure of the Crab pulsar and wisp motions in the Crab nebula indicate that pulsar magnetospheres may contain large amounts of nonrelativistic gas. Substantial accumulation can occur only in the vicinity of the force balanced radius where gravitational and centrifugal forces cancel. Approximate models for the magnetic field structure have been constructed considering the cases of aligned and orthogonal spin and magnetic axes. The abilities and limitations of the model are analyzed. Dissert. Abstr.

N74-21421 Illinois Univ., Urbana.
THE RADIATION BELTS OF JUPITER Ph.D. Thesis
Joseph Jean Charles Degioanni 1973 133 p
Avail: Univ. Microfilms Order No. 74-5551

A model of the Jovian radiation belts is assumed to consist of a dipolar magnetic field inclined ten degrees to the axis of rotation and of trapped relativistic electrons whose motions can be described by the guiding-center approximation. Synchrotron emission from these electrons results in the observed non-thermal microwave spectrum. The IBM 360/75 computer at the University of Illinois was used to calculate the Stokes parameters of synchrotron radiation integrated over a dipolar shell as a function of the energy-dependent variable. The integration takes into account the partial eclipse of the dipolar shells by the planet at different System 3 longitudes. Futhermore, the Stokes parameters are integrated separately for two type of electron populations, i.e., one whose pitch angle distribution is isotropic, and another whose distribution is sharply confined to the magnetic equator. Dissert. Abstr.

N74-21422 TRW Systems Group, Redondo Beach, Calif.
TRW SPACE LOG, VOLUME 12
Jim Schefter 1973 49 p refs
Copyright. Avail: Issuing Activity

A summary of space activity is presented based on information provided by NASA, Department of Defense, Library of Congress, United Nations, and others. The subjects discussed are: (1) America's future in space, (2) spacecraft details, (3) Pioneer missions to Jupiter, (4) record of U.S. space launches, and (5) spacecraft totals. P.N.F.

N74-21423 Illinois Univ., Urbana.
PULSAR ELECTRODYNAMICS Ph.D. Thesis
Satoshi Hinata 1973 67 p
Avail: Univ. Microfilms Order No. 74-5592

The behavior of charges in a self-consistent electric field in the presence of the poloidal current about an aligned magnetic rotator is investigated. The energy of a charge is obtained as a function of distance along the trajectory, with radiation reaction taken into consideration. It is shown from this that the curvature radiation loss dominates the kinetic energy of the charge within approximately one stellar radius. The luminosity is then obtained. The braking index for an aligned rotator is obtained as n = 2.2. The surface magnetic field strength is also estimated as B sub 0 = 10 to the 10th power approximates 10 to the 12th power gauss from the observation of luminosity. The spectrum of the curvature radiation and the assumed magnetic field configuration enable us to estimate how many pairs are produced per second, where they are produced, as well as the criterion for the pair production to take place. It is found that the pair production is likely to take place around PSR 531, 833, and 525. Dissert. Abstr.

N74-21424 Washington Univ., St. Louis, Mo.
THERMOLUMINESCENCE STUDIES OF THE IRRADIATION HISTORY OF LUNAR ROCKS Ph.D. Thesis
Howard Phillips Hoyt, Jr. 1973 122 p
Avail: Univ. Microfilms Order No. 74-7044

The general characteristics of the thermoluminescence (TL) of lunar samples are described and indicate that TL represents a dynamic equilibrium between build up from ionizing radiation and loss due to thermal draining. Differences between levels for various samples are interpreted as reflecting differences in average lunar dose rate and temperature. The thermal behavior of small rocks on the lunar surface is considered, and it is shown that their temperature changes so slowly that large gradients do not build up. Therefore, the variation of TL with depth reflects only the variation of dose rate and is used to obtain the solar flare proton spectrum averaged over the TL equilibrium time. The dose-rate depth profile in lunar rocks is produced by three sources: radiations from primordial radionuclides (U, Th, K), galactic cosmic rays, and solar flare protons. Dissert. Abstr.

N74-21425 California Univ., Los Angeles.
THE INFLUENCE OF LARGE-SCALE TOPOGRAPHY ON THERMALLY FORCED PLANETARY CIRCULATIONS Ph.D. Thesis
Jeong- Woo Kim 1973 139 p
Avail: Univ. Microfilms Order No. 74-3979

Topographic influences on thermally forced planetary circulations are studied with a two-level truncated spectral model based on the quasi-geostrophic system of equations for a cyclic zonal channel on a beta plane. The circulation in the model consists of three components: stationary zonal meanflow, steady moving waves, and a topographically forced stationary wave. The linearized equations are used for the waves but their feedback on the zonal meanflow is taken into account. Under an imposed equilibrium thermal field, the circulation is found in such a way that the zonal meanflow is stable with respect to all waves. The results for different imposed thermal fields, including the partition of energy, are shown. Dissert. Abstr.

N74-21426 Yeshiva Univ., New York.
EARLY EVOLUTION OF PLANET EARTH Ph.D. Thesis
Jacob Abe Teller 1973 94 p
Avail: Univ. Microfilms Order No. 74-7866

Models of a primitive earth with elevated central temperatures were constructed. These models obeyed the equations of stellar structure and had a solid earth-like core and condensed cover of MgSiO compounds in chemical equilibrium. On top of this was an extended atmosphere of the gaseous compounds of MgSiO, and any cloud condensate of MgSiO3, that formed. Opacities, used to define the photosphere, and therefore the surface luminosity, were calculated from the components of SiO, MgO, SiO2 and MgSiO3 condensate that were in equilibrium in the atmosphere, all of which absorb somewhat in the infrared. Models were calculated from temperatures of 30,000 K which was the limit of these objects being gravitationally bound, down to a temperature of 6,000 K, at which point the atmosphere of MgSiO components disappeared. At this point, the earth was said to be formed. Dissert. Abstr.

N74-21427*# Minnesota Univ., Minneapolis. School of Physics and Astronomy.
THE 3.5 MICRON LIGHT CURVES OF LONG PERIOD VARIABLE STARS Ph.D. Thesis
Donald Walter Strecker Dec. 1973 205 p refs
(Grant NGL-24-005-008)
(NASA-CR-138078; Rept-15) Avail: NTIS HC $13.25 CSCL 03A

Infrared observations at an effective wavelength of 3.5 microns of a selected group of long period variable (LPV) stars are presented. Mira type and semiregular stars of M, S, and C spectral classifications were monitored throughout the full cycle of variability. Although the variable infrared radiation does not exactly repeat in intensity or time, the regularity is sufficient to produce mean 3.5 micron light curves. The 3.5 micron maximum radiation lags the visual maximum by about one-seventh of a cycle, while the minimum 3.5 micron intensity occurs nearly one-half cycle after infrared maximum. In some stars, there are inflections

or humps on the ascending portion of the 3.5 micron light curve which may also be seen in the visual variations. Author

N74-21428*# SCI Electronics, Inc., Huntsville, Ala.
A SATURN LAUNCHED X-RAY ASTRONOMY EXPERIMENT. VOLUME 2: S-150 Final Program Report
11 Mar. 1971 92 p
(Contract NAS8-21015)
(NASA-CR-120167) Avail: NTIS HC $7.75 CSCL 03A

In order to develop an experiment which would provide previously unknown information at the projected new launch period, a decision was made to modify the S-027 experiment to allow detection of lower energies which had previously not been mapped. The modification basically required that the static counters be replaced with a thin film entrance window gas flow counter which would allow detection of X-ray energies as low as 150 ev. The new experiment designated S-150 was designed to detect X-ray energies over a spectrum of 150 ev to 10 Kev. Photographs of the S-150 experiment are shown. Basically the same signal detection and processing techniques were used on the S-150 experiment as were used on the S-027. For economic reasons much of the S-027 subassembly hardware was used on the new experiment. The main design changes were in the signal detection system and the high energy veto system. Author

N74-21429*# Stanford Univ., Calif. Inst. for Plasma Research.
A STUDY OF POSSIBLE MODELS FOR BALMER EMISSION LINE REGIONS IN SEYFERT GALAXIES
William M. Adams Dec. 1973 90 p refs
(Grant NGL-05-020-272; Contract N00014-67-A-0112-0062; Grant NSF GP-23840; NR Proj. 323-009)
(NASA-CR-137431; AD-772628; SU-IPR-553) Avail: NTIS HC $7.50 CSCL 03A

Two unexplained phenomena exhibited by the Balmer emission lines in Seyfert galaxies, their unique profile structure, and their anomalous intensity ratios are examined. Models of three proposed mechanisms for explaining the broad wings found on the Balmer lines are presented: (1) a uniform medium in which self-absorption of allowed lines increases their escape path length, thus increasing the probability of their being electron scattered so as to account for the wings; (2) the line wings are formed in a separate region with high velocity dispersion; and (3) the lines with wings are formed in a separate region where the electron optical depth is greater, thus creating the wings by electron scattering. The evidence favors the third possibility. A brief review of the results of basic radiative recombination theory is presented followed by an investigation of the appropriateness of using a Maxwellian electron distribution function in collisional excitation calculations. It is determined that under some conditions this distribution function may become significantly non-Maxwellian. Author

N74-21430*# Toledo Univ., Ohio.
THE SURFACE BRIGHTNESS OF REFLECTION NEBULAE Ph.D. Thesis, Dec. 1972
William F. Rush 10 Jan. 1974 124 p refs
(Grant NGR-36-010-016)
(NASA-CR-138072) Avail: NTIS HC $9.25 CSCL 03A

Hubble's equation relating the maximum apparent angular extent of a reflection nebula to the apparent magnitude of the illuminating star has been reconsidered under a set of less restrictive assumptions. A computational technique is developed which permits the use of fits to observed m, log a values to determine the albedo of the particles composing reflection nebulae, providing only that one assumes a particular phase function. Despite the fact that all orders of scattering, anisotropic phase functions, and illumination by the general stellar field are considered, the albedo which is determined for reflection nebulae by this method appears larger than that for interstellar particles in general. The possibility that the higher surface brightness might be due to a continuous fluorescence mechanism is considered both theoretically and observationally. Author

N74-21431*# Alabama Univ., Huntsville. Div. of Graduate Programs and Research.
ENVIRONMENTAL DESIGN CRITERIA Summary Report, Mar. 1970 - Feb. 1974
Shi Tsan Wu Feb. 1974 16 p refs
(Contract NAS8-25750)
(NASA-CR-120192) Avail: NTIS HC $4.00 CSCL 22B

Wind velocities at 140-200 km altitude were observed by a Low-G Accelerometer Calibration System (LOGACS) flown on an Agena satellite during a geomagnetic storm. An interesting wind reversal observed by the satellite at auroral latitudes is satisfactorily explained by the neutral air motion caused by the E x B drift deduced from the ground-based geomagnetic data recorded at stations near the meridian of the satellite orbit. Author

N74-21432*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SAO/NASA JOINT INVESTIGATION OF ASTRONOMICAL VIEWING QUALITY AT MOUNT HOPKINS OBSERVATORY: 1969-1971
M. R. Pearlman (Smithsonian Astrophys. Obs.), J. L. Bufton, D. Hogan (Smithsonian Astrophys. Obs.), D. Kurtenbach (Smithsonian Astrophys. Obs.), and K. Goodwin (Smithsonian Astrophys. Obs.) Cambridge, Mass. Smithsonian Astrophys. Obs. 23 Jan. 1974 143 p refs Prepared in cooperation with Smithsonian Astrophys. Obs.
(Contract NAS12-2129)
(NASA-TM-X-70017; SAO-Special-Rept-357; SAO-304-045) Avail: NTIS HC $10.25 CSCL 03A

Quantitative measurements of the astronomical seeing conditions have been made with a stellar-image monitor system at the Mt. Hopkins Observatory in Arizona. The results of this joint SAO-NASA experiment indicate that for a 15-cm-diameter telescope, image motion is typically 1 arcsec or less and that intensity fluctuations due to scintillation have a coefficient of irradiance variance of less than 0.12 on the average. Correlations between seeing quality and local meteorological conditions were investigated. Local temperature fluctuations and temperature gradients were found to be indicators of image-motion conditions, while high-altitude-wind conditions were shown to be somewhat correlated with scintillation-spectrum bandwidth. The theoretical basis for the relationship of atmospheric turbulence to optical effects is discussed in some detail, along with a description of the equipment used in the experiment. General site-testing comments and applications of the seeing-test results are also included. Author

N74-21433*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ASYMPTOTIC SOLUTION TO THE TANGENTIAL LOW THRUST ENERGY INCREASE TRAJECTORY
Klaus Schwenzfeger Nov. 1973 52 p
(NASA-TM-X-64836) Avail: NTIS HC $5.75 CSCL 22C

A approximate analytic solution to the low thrust constant acceleration energy increase trajectory using a tangential steering program is presented. The solution is based on a two-variable asymptotic expansion of the equations of motion formulated in regularized variables. The high accuracy of the second order solution derived is demonstrated by comparing it with numerically integrated trajectories. Author

N74-21434*# California Inst. of Tech., Pasadena.
[RESEARCH ON INFRARED ASTROPHYSICS AND X RAY AND XUV ASTRONOMY] Semiannual Status Report, 1 Oct. 1973 - 30 Mar. 1974
11 Apr. 1974 17 p refs
(Grants NGL-05-002-207; NGL-05-002-007)
(NASA-CR-137428) Avail: NTIS HC $4.00 CSCL 03A

The infrared research was divided into two related subjects, observations at wavelengths less than 34 microns and millimeter wavelength observations. A new complex of infrared sources in the Orion Nebula observed along with a broad range of galactic and extragalactic objects. The Comet Kohoutek was measured in the 1-20 micron wavelength region and its thermal properties agreed closely with those of Comet Ikeya-Seki. Combined infrared and photoelectric studies of the Makarian galaxies showed them to have a composite spectrum with a large emission feature in the far infrared. The development of one millimeter photometry and composited bolometers is described. A technique of reconstructing two dimensional surface brightness distributions

with appropriate errors from individual strip scans was developed. Model parameters were determined by fitting data in non-linear systems. Results show spectral parameter uncertainties are underestimated or incorrectly evaluated in most studies. Author

N74-21435*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
INVESTIGATION OF ULTRAVIOLET FLUXES OF NORMAL AND PECULIAR STARS Final Report
William A. Deutschman and Rudolph E. Schild Apr. 1974 42 p refs
(Grant NGR-09-015-201)
(NASA-CR-137411) Avail: NTIS HC $5.25 CSCL 03B

Data from Project Celescope, a program that photographed the ultraviolet sky, in order to study several problems in current astrophysics are analyzed. Two star clusters, the Pleiades and the Hyades, reveal differences between the two that we are unable to explain simply from their differences in chemical abundance, rotation, or reddening. Data for Orion show large scatter, which appears to be in the sense that the Orion stars are too faint for their ground-based photometry. Similarly, many supergiants in the association Sco OB1 are too faint in the ultraviolet, but the ultraviolet brightness appears to be only poorly correlated with spectral type. Ultraviolet Celescope data for several groups of peculiar stars have also been analyzed. The strong He I stars are too faint in the ultraviolet, possibly owing to enhancement of O II continuous opacity due to oxygen overabundance. The Be stars appear to have ultraviolet colors normal for their MK spectral types. The P Cygni stars are considerably fainter than main-sequence stars of comparable spectral type, probably owing, at least in part, to line blocking by resonance lines of multiply ionized light metals. The Wolf-Rayet stars have ultraviolet color temperatures of O stars. Author

N74-21436*# California Univ., Los Angeles. Dept. of Geology.
MICROPALEONTOLOGICAL STUDIES OF LUNAR AND TERRESTRIAL PRECAMBRIAN MATERIALS Final Report
J. William Schopf Mar. 1974 14 p refs
(Grant NGR-05-007-292)
(NASA-CR-134232) Avail: NTIS HC $4.00 CSCL 03B

Optical microscopic and scanning electron microscopic studies of rock chips and dust returned by Apollo 14, 15, 16, and 17 are analyzed along with optical microscopic studies of petrographic thin sections of breccias and basalts returned by Apollo 14, 15, and 16. Results show no evidence of modern or fossil lunar organisms. The lunar surface is now, and apparently has been throughout the geologic past, inimical to known biologic systems. Author

N74-21437# Michigan Univ., Ann Arbor. High Altitude Engineering Lab.
FEASIBILITY OF SATELLITE MEASUREMENT OF STRATOSPHERIC MINOR CONSTITUENTS BY SOLAR OCCULTATION
S. R. Drayson, F. L. Bartman, W. R. Kuhn, and R. Tallamraju Oct. 1973 113 p refs
(Grant NOAA-NG-10-72; ORA Proj. 011023)
(Rept-011023-2-T) Avail: NTIS HC $8.75 CSCL 04A

The determination of stratospheric concentration of minor constituents by satellite solar occulation is examined. The method is shown feasible for ozone up to 50 km, water vapor up to 50 km, nitrous oxide up to 30 km, methane up to 50 km and carbon monoxide up to 20 km. Transmittance calculations for these and other gasses are presented for optimal spectral regions. Calculations of extinction by aerosols in the lower stratosphere show a dominant effect in the window regions near 10 microns. Several inversion techniques are developed and examples of profiles retrieved by different methods are compared. Computer programs are described to calculate the transmittances by the use of a band model and by the line-by-line integration technique. Author

N74-21438# Joint Publications Research Service, Arlington, Va.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO 322
11 Apr. 1974 61 p refs Transl. into ENGLISH from various Soviet bloc publications
(JPRS-61722) Avail: NTIS HC $6.25

Translations and abstracts are presented of articles on meteorology, oceanography, upper atmosphere and space research, astronomy and terrestrial geophysics, covering both science news and formal scientific reports. Author

N74-21439# Joint Publications Research Service, Arlington, Va.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 321
29 Mar. 1974 50 p refs Transl. into ENGLISH from various Soviet bloc publications
(JPRS-61620) Avail: NTIS HC $5.50

Translations and abstracts of articles on meteorology, oceanography, upper atmosphere and space research, astronomy and terrestrial geophysics, covering both science news and formal scientific reports are presented. Published details of Soviet space spectaculars are included. Author

N74-21440*# National Aeronautics and Space Administration, Washington, D.C.
HIGH ENERGY PHENOMENA ON THE SUN
R. Ramaty, ed. and R. G. Stone, ed. 1973 640 p refs Symp. held at Greenbelt, Md., 28-30 Sep. 1972
(NASA-SP-342; LC-74-600025) Avail: NTIS MF $1.45; SOD HC $5.75 CSCL 03B

The proceedings of a symposium of high energy phenomena on the sun are presented. The subjects discussed include the following: (1) flare theories and optical observations, (2) microwave and hard X-ray observations, (3) ultraviolet and soft X-ray emissions, (4) nuclear reactions in solar flares, (5) energetic particles from the sun, (6) magnetic fields and particle storage, and (7) radio emissions in the corona and interplanetary space. For individual titles, see N74-21441 through N74-21490.

N74-21441* Stanford Univ., Calif.
MASS MOTION IN SOLAR FLARES **c29**
P. A. Sturrock *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 3-11 refs (For availability see N74-21440 12-30)
(Grants NGR-05-020-272; NGR-05-020-512)
CSCL 03B

Mass motions in solar flares are here considered in terms of a previously proposed model. Particle acceleration occurs during reconnection of a current sheet located at coronal heights. The downward component of the particle flux produces an impulsive hard X-ray burst and heats the upper layers of the chromosphere sufficiently to lead to explosive evaporation. Some of the evaporated gas remains trapped in newly closed magnetic field lines and is responsible for the soft thermal component of X-ray emission. Gas which flows along open magnetic field lines subsequently forms a plasmoid which is ejected by magnetic stresses into interplanetary space and may subsequently cause a geomagnetic storm. Analysis of a highly simplified model leads to formulas for the density, temperature, and other parameters of the flare-produced plasma in terms of a length scale and mean magnetic field strength for the flare. Author

N74-21442* Imperial Coll. of Science and Technology, London (England).
ENERGETIC PARTICLES AS A SOURCE OF FLARE ENERGY **c29**
H Elliot *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 12-18 refs (For availability see N74-21440 12-30)
CSCL 03B

The production of solar flares by the reservoir of energy generated by sunspot magnetic fields is discussed. Electrons play an important part in the flare process since high energy electrons are responsible for X-ray and radio emission. The energy required in the form of protons trapped in sunspot magnetic fields to produce large solar flares is analyzed. A trigger mechanism is described where the particles can be rapidly dumped into the chromosphere when fast electrons are produced by Coulomb collisions and through pion production by the highest energy protons. Author

N74-21443* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR FLARE OBSERVATIONS AND SOLAR FLARE MODELS **c29**
Charles L. Hyder *In its* High Energy Phenomena on the Sun 1973 p 19-25 refs (For availability see N74-21440 12-30)
CSCL 03B

The use of solar flare models based on specific and detailed observations of solar flares is discussed. A process for determining the validity of various solar models is analyzed. The process relegates the infall-impact model for flares to a secondary role in high energy solar events. The strictly thermal infall-impact model cannot lead to temperatures greater than five million degrees K. Another process is needed to explain the high energy aspects of solar flares which are related to temperatures equal to or greater than 10 to the 7th power degrees K, nonthermal X-ray and radio emissions, white light flares, high energy particles from the sun, and gamma ray producing particles in the sun. Author

N74-21444* Hale Observatories, Pasadena, Calif.
OPTICAL OBSERVATIONS OF THE AUGUST 1972 FLARES
Katsuo Tanaka and Harold Zirin *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 27-54 refs (For availability see N74-21440 12-30)
(Grants NGR-57-002-071; NSF GA-24015)
CSCL 03B

The optical appearance of the solar flares in McMath 11976 is described. The region showed complex, twisted magnetic fields from its birth on July 11, 1972. The flares occurred because of high field gradients and sheared field lines, which made transitions to lower energy field configurations possible. The H-alpha emission comes mainly from intense kernels about 10,000 kilometers across in each magnetic polarity. The measurement of the spectra and its relationship to the emission of impulsive flares is discussed. The peak emission of H-alpha from the kernels and the peak 3835 Angstrom flashes agree well with the hard X-ray peak. Author

N74-21445* California Univ., Berkeley. Space Sciences Lab.
CHARACTERISTICS OF NONTHERMAL ELECTRONS ACCELERATED DURING THE FLASH PHASE OF SMALL SOLAR FLARES **c29**
S. R. Kane *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 55-77 refs (For availability see N74-21440 12-30)
(Contract NAS5-9094; Grant NGL-05-003-017)
CSCL 03B

Observations of impulsive hard X-rays and other flash phase emissions from small solar flares are analyzed in order to determine the characteristics of energetic electrons accelerated during the flash phase. The electron spectrum and its time variation are deduced from a model of the X-ray source in which the electron injection is continuous, and the electron energy loss is primarily due to collisions with the ambient plasma and escape into the corona. The instantaneous electron spectrum in the X-ray source, as well as the acceleration spectrum, are found to be nonthermal. The observations are consistent with a flare model having the following properties: (1) the acceleration region is located in the lower corona where the ion density is less than 10 to the 9th power per cubic centimeter, (2) the total kinetic energy of the nonthermal electron is approximately 10 percent of the total flare energy, so that the efficiency of the acceleration process is very high, (3) the nonthermal electrons (and protons) provide energy for all flash phase emissions, (4) the acceleration is a continuous process with a time constant less than 1 second, or a continuous series of impulses each lasting less than 1 second and a total duration of approximately 100 seconds, (5) the electron spectrum continuously hardens during the increasing phase of the X-ray burst and softens during the decreasing phase and, (6) the more energetic flares to not necessarily produce a harder electron spectrum. Author

N74-21446* Nagoya Univ. (Japan). Research Inst. of Atmospherics.
STRUCTURE OF PROTON CENTERS AND ASSOCIATED NONTHERMAL BURSTS AT MICROWAVE FREQUENCIES **c07**
Shinzo Enome and Haruo Tanaka *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 78-86 refs (For availability see N74-21440 12-30)
CSCL 03B

A very broad band of electromagnetic radiation is emitted during solar flares, especially at the explosive phase. The existence of a large variety of plasmas with various densities and a wide range of temperatures or energies is proposed as the initiating agent. The manner in which the plasmas are heated and accelerated to subrelativistic and relativistic energies is discussed. Observational evidence on the characteristics of active regions which produced proton flares and on the structure of the associated nonthermal microwave bursts of the sun is presented. The behavior of subrelativistic electrons on the sun is described. Author

N74-21447* Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
SPECTRAL CHARACTERISTICS OF MICROWAVE BURSTS **c07**
Donald A. Guidice and John P. Castelli *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 87-103 refs (For availability see N74-21440 12-30)
CSCL 03B

Various statistical parameters of the peak flux-density spectra of solar microwave bursts have been examined for 1968 to 1971 based on spectra obtained from fixed-frequency observations at 245, 606, 1415, 2695, 4995, 8800, 15400, and 35000 MHz. For bursts having a centimeter-radiation component, the great majority were found to have type C spectra (single spectral maximum) in the L-band to K-band range. A small percentage had miscellaneous type spectra (more than one spectral maximum) and another small percentage had what might be taken as thermal spectra. Even for gradual rise-and-fall bursts often thought to be thermal origin, less than 20 percent were found to have spectra which could be classified as thermal. The relationship between the burst spectral maximum (f sub max) and the photospheric magnetic field strength of the region associated with the burst was examined. A tendency for greater correlation at higher f sub max for stronger magnetic fields is noted; however, this is over-shadowed by the overall high correlations for those regions having strong photospheric magnetic fields. Author

N74-21448* Maryland Univ., College Park. Astronomy Program.
MILLIMETER WAVELENGTH OBSERVATIONS OF SOLAR ACTIVE REGIONS **c07**
M. R. Kundu *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 104-113 refs (For availability see N74-21440 12-30)
CSCL 03B

Polarization properties of active regions at 9 mm are discussed, and the observed degree of polarization is used to obtain an estimate of chromospheric magnetic fields. Also discussed is the polarization structure at 9 mm of an active region that produced a minor flare around 1900 UT on September 28, 1971. Total power observations indicate that new regions develop, or weak regions intensify at millimeter wavelengths as a result of bursts at distant sites. The spectra of the peak flux density of moderately strong bursts observed at 9 mm show a sharp drop toward the shorter millimeter wavelengths. The weak bursts at 3.5 mm are manifest mainly as heating phenomena. Author

N74-21449* Radio and Space Research Station, Slough (England).
SOLAR MILLIMETER BURSTS **c07**
David L. Croom *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 114-123 refs (For availability see N74-21440 12-30)
CSCL 03B

Solar burst observations in the region above 10 GHz (wavelengths less than 3 cm.) are discussed. Observations have shown that many major solar events have large millimeter wave components. The total burst radio energy is frequently concentrated in this part of the spectrum. Graphs are presented showing the peak flux density spectrum for bursts on specific dates. Microwave burst mean duration is plotted as a function of the particle energy. Author

N74-21450* American Science and Engineering, Inc., Cambridge, Mass.
POSSIBLE LOW ENERGY (E LESS THAN keV) NONTHERMAL X-RAY EVENTS **c23**
S. W. Kahler *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 124-131 refs (For availability see N74-21440 12-30)
CSCL 03B

A search of the 3- to 30-keV data from the NRL proportional counter detector on the Orbiting Geophysical Observatory-5 (OGO-5) satellite has yielded several events which may be nearly completely nonthermal in the e greater than 3 and less than 10 keV range. In each case an impulsive hard X-ray burst accompained by an impulsive microwave burst was associated with a low energy X-ray burst whose profile was a simple rise and fall. The lack of a two component nature in the low energy range argues that the low energy X-ray flux is due to a single physical mechanism, in this case nonthermal bremsstrahlung from accelerated electrons. However, the spectra and time profiles are quite consistent with a thermal interpretation. Polarization measurements are probably necessary to resolve the physical origin of such bursts. Author

N74-21451* California Univ., San Diego.
THERMAL AND NONTHERMAL X-RAY BURSTS OBSERVED FROM OSO-7 **c23**
L. E. Peterson, D. W. Datlowe, and D. L. McKenzie *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 132-146 refs (For availability see N74-21440 12-30)
(Contract NAS5-11081)
CSCL 03B

The UCSD solar X-ray experiment on the OSO-7 observes X-rays in the 2 to 15 keV range with a proportional counter and in the 10.6 to 300 keV range with a scintillation counter. The dynamic range and instrument parameters are chosen to separate X-ray emission due to a hot thermal plasma from that due to nonthermal electron populations for a large number of X-ray events associated with small flares. Many different morphological classes have been observed in the 200 or so principal events observed between October 1971 and June 1972. For events which have both a thermal and nonthermal component, we can perform an analysis which shows that in not all events is it possible for the nonthermal electrons to energize the thermal plasma. We observe many events which have no nonthermal component, at least one event which was purely power law on initiation, and several events which had a long, slow decay of the hard X-rays. Author

N74-21452* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OBSERVATION OF MeV GAMMA-RAY EVENTS DURING MAY 1967 FROM ERS-18 **c29**
D. E. Gruber (Calif. Univ., San Diego) and L. E. Peterson (Calif. Univ., San Diego) *In its* High Energy Phenomena on the Sun 1973 p 147-161 refs (For availability see N74-21440 12-30)
(Contract F04701-68-C-0108)
CSCL 03B

Gamma-ray fluxes between 25 keV and 6 MeV were observed by instruments aboard the Environmental Research Satellite-18 (ERS-18)during the great solar flares of May 21 and May 23, 1967. Measurements were made with a 6.35-cm-diameter by 7.65-cm-long NaI scintillation counter with five differential channels between 0.25 and 6.0 MeV. Data obtained during the event at 1945 UT on May 23, 1967, can be fitted by a two-part, power-law, differential-number spectrum. One part is of spectral index 3.2 between 8 keV and 0.6 MeV, and the other is of spectral index 1.2 above 0.6 MeV. An upper limit of 0.52 photons is set for 2.23 MeV line strength for this event. In all three bursts, tentatively associated with white light flares, the MeV-range fluxes declined more slowly than the 25-keV fluxes. Author

N74-21453* Columbia Univ., New York. Columbia Astrophysics Lab.
HIGH-ENERGY SOLAR X-RAY POLARIMETRY **c23**
R. S. Wolff *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 162-175 refs (For availability see N74-21440 12-30)
(Grants NGR-33-008-125; AF-AFOSR-1945-70)
CSCL 03B

The evidence for the existence of a highly energetic nonthermal electron distribution in the solar atmosphere during energetic flares is presented. Relationships are discussed between the proposed X-ray emission processes, electron distribution, and possible X-ray polarization. A description of various techniques of measuring X-ray polarization is given, and the applicability of these methods to the problem of solar X-ray measurements is considered. An idealized polarimeter capable of obtaining the most useful data related to the energetics of solar flares is proposed, and current and projected polarization experiments are discussed. Author

N74-21454* Tokyo Univ. (Japan). Dept of Astronomy.
THEORY OF MICROWAVE AND X-RAY EMISSION **c29**
Tatsuo Takakura *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 179-187 refs (For availability see N74-21440 12-30)
CSCL 03B

The behaviour of the nonthermal electrons created at the impulsive phase of flares has been deduced from the microwave impulsive bursts and hard X-ray burst by many researchers. There is almost no doubt of the emission mechanisms that radio emissions are due to gyrosynchrotron emission and hard X-rays are collisional bremsstrahlung. However, there remain three controversial problems. One is whether the emission sources of the microwave impulsive burst and hard X-ray burst are common or not. Another is whether the injection of the nonthermal electrons into the source is impulsive or continuous. The other is the relation among the nonthermal electrons, soft X-rays, EUV flash, H-alpha kernels, and white light flares. These three problems are not independent of each other. Author

N74-21455* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THEORY OF SOLAR MICROWAVE BURSTS **c29**
R. Ramaty *In its* High Energy Phenomena on the Sun 1973 p 188-197 refs (For availability see N74-21440 12-30)
CSCL 03B

The theory of solar microwave bursts is discussed in terms of gyrosynchrotron emission and absorption in a magnetoactive plasma and other absorption processes by the background medium. Simplified formulas for all turnover frequencies are given. Above about 2 GHz the most likely absorption processes for large bursts are free-free absorption and gyrosynchrotron self-absorption. The former process is capable of producing flux densities which are flat or slowly varying functions of frequency. The latter process sets absolute upper limits on the intensities of microwave bursts, which at a given frequency, depend only on the magnetic field in the source region. Author

N74-21456* Ohio State Univ., Columbus. Dept. of Electrical Engineering.
GYROSYNCHROTRON RADIATION FORMULAE **c24**
H. C. Ko *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 198-206 refs Sponsored in part by AFCRL (For availability see N74-21440 12-30)
CSCL 03B

The wave-normal emissivity and the ray emissivity formulas for an electron moving along a helical path in a magnetoactive medium are presented. Simplified formulas for the case of an isotropic plasma are also given. Because of the helical motion of the electron, a difference exists between the radiated power per unit solid angle and the received power per unit solid angle. The relation between these two quantities in a magnetoactive medium is shown. Results are compared with those obtained by others, and the sources of discrepancies are pointed out. Author

N74-21457* California Univ., San Diego. Dept. of Physics.
NONTHERMAL X-RAYS AND RELATED PROCESSES **c29**
H. S. Hudson *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 207-220 refs (For availability see N74-21440 12-30)
(Contract NAS8-28015)
CSCL 03B

The hard X-rays associated with solar flares represent the

bremsstrahlung of nonthermal electron streams. In the initial phase of the flare, the X-rays probably come from a dense region in the chromosphere, as a consequence of precipitation from the lower corona. A gradual nonthermal X-ray burst may occur in a later phase, probably caused by the electrons responsible for the type 4 burst. The bombardment of the chromosphere during the early phase of the flare releases a large amount of energy there. This energy can support many of the observed flash-phase phenomena. We therefore consider this picture of flare energetics: The energy initially goes into fast particles. These interact with the chromosphere, which expands to form the hot region observed in the corona. This hot region then provides energy for many of the main-phase flare phenomena, such as H-alpha emission. The bulk of the energy in the bombardment must reside in the electron component. A clear test of the whole picture lies in its prediction of a strong infrared excess during the flash phase. Author

N74-21458* Hale Observatories, Pasadena, Calif.
OPTICAL, HARD X-RAY, AND MICROWAVE EMISSION DURING THE IMPULSIVE PHASE OF FLARES **c29**
Joan A. Vorpahl *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 221-227 refs (For availability see N74-21440 12-30)
(Contract NAS5-9094; Grants NGL-05-003-017; NGL-05-002-034; NSF GA-31587)
CSCL 03B

A study was made of the variation in hard (E greater than or equal to 10 keV) X-radiation, H-alpha, and microwave emission during the impulsive phase of solar flares. Most important, the observations showed that there is an optical impulsive component in addition to the well-known hard X-ray and microwave spikes. Properties of these H-alpha kernels are given. Further analysis shows that the rise time in the 20- to 32-keV X-ray spike depends on the slope in the electron spectrum. A picture of the impulsive phase is given that is consistent with observations of the three above emissions. Author

N74-21459* Harvard Coll. Observatory, Cambridge, Mass.
THE EXTREME ULTRAVIOLET SPECTRUM OF SOLAR FLARES **c29**
Robert W. Noyes *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 231-241 refs Prepared in cooperation with Smithsonian Astrophysical Observatory (For availability see N74-21440 12-30)
(Contract NAS5-9274)
CSCL 03B

Extreme ultraviolet flare observations are discussed, with particular attention to relative variations of spectral features during flares. An approximately equal enhancement of most chromospheric, transition-zone, and coronal lines indicates that the thermal conduction may be important at temperatures between 100,000 and one million K in the flare plasma. However, enhancements sometimes appear to be somewhat larger for transition-zone lines and for density-sensitive lines arising from metastable levels. EUV lines characteristics of temperatures between 10,000 and 1.5 million K all show a nearly simultaneous rise in impulsive flares, coincident with the hard X-ray burst. Density increases by factors of 5 to 10 in the transition zone are inferred from emission-measure increases and from line ratios for small flares. Author

N74-21460* National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
GROUND-BASED OBSERVATIONS OF EUV FLARE EMISSIONS
Richard F. Donnelly *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 242-261 refs (For availability see N74-21440 12-30)
CSCL 03B

Ground-based observations have established that impulsive extreme-ultraviolet (EUV) flashes occur during solar flares, in close association with hard X-ray bursts and certain impulsive portions of the optical flare. The energy flux radiated in the 10 to 1030 Angstroms wavelength range exceeds that in hard X-rays (greater than or equal to 10 keV) by about 100,000, and is roughly comparable to the energy flux radiated at all optical wavelengths. In this paper our current knowledge of EUV flare radiation and ground-based observations of the radiations are reviewed. Several hypotheses are proposed about the interrelation between impulsive EUV emissions and other flare radiations, their spatial location, and association with magnetic fields. Author

N74-21461* Naval Research Lab., Washington, D.C. E. O. Hulbert Center for Space Research.
SOFT X-RAY FLARE SPECTRA **c29**
G. A. Doschek and J. F. Meekins *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 262-275 refs (For availability see N74-21440 12-30)
CSCL 03B

Large solar flares produce intense soft X-ray emission, indicating the existence of high temperature plasmas that coexist in time with the plasmas responsible for the normally observed brightenings in H-alpha. The time behavior of the X-ray flux, as revealed, for example, by ion chamber detectors on the series of Solrad monitoring satellites, appears to roughly mimic the intensity-time behavior of the H-alpha flare, insofar as start times, times of maximum flux, and approximate decay times are concerned. In recent years, soft X-ray spectra of both active regions and solar flares have been obtained by instruments flown on spacecraft such as the Orbiting Solar Observatory (OSO) series. The disbursing elements used were Bragg crystals, and in the 8 Angstrom region the resolution is typically approximately 1200. This paper discusses the observed characteristics of X-ray flare spectra and spectroscopic diagnostics for determining electron temperatures, electron densities, and departures from ionization equilibrium within the soft X-ray emitting plasma. Author

N74-21462* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FURTHER RESULTS ON COOLING MECHANISMS FOR SOFT X-RAY FLARES **c29**
I. J. D. Craig (Univ. Coll., London), J. L. Culhane (Univ. Coll., London), K. J. H. Phillips, and J. F. Vesecky (Leicester Univ.) *In its* High Energy phenomena on the Sun 1973 p 276-282 refs (For availability see N74-21440 12-30)
CSCL 03B

Analysis of data from the soft X-ray proportional counter spectrometer on OSO-4 has been continued along the lines of earlier work. It was noticed that the time profiles of X-ray counts from the OSO-4 instrument's 1 to 3 Angstrom detectors for two events showed a very rapid initial decay after maximum, followed by a much more slowly falling section. At least in the case of the larger of the two events, the change of slope seems quite definitely to be discontinuous. Temperatures and emission measures for both flares have been derived, by fitting an emission function to eight-channel count histograms which form the output of the 1 to 3 Angstrom detectors, analyzed into eight energy intervals by pulse-height analysis. The computer program is described. It employs temperature and continuum emission measures in the Culhane-Acton formula and the flux in the 6.7 KeV iron-line feature as free parameters, adjusting them by small amounts in successive iterations until the original histogram is approximately reproduced. A chi-squared is used to examine the agreement between histograms and terminates the iteration accordingly. Account is taken of the proportional counters' energy resolution in the fitting process.

N74-21463* New Hampshire Univ., Durham.
SOLAR GAMMA RAY AND NEUTRON OBSERVATIONS **c29**
E. L. Chupp (Max Planck Inst. for Physics and Astrophysics), D. J. Forrest, and A. N. Suri *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 283-300 refs (For availability see N74-21440 12-30)
(Contract NAS5-11054; Grant NGL-30-002-021)
CSCL 03B

The present status of knowledge concerning the impulsive and the continuous emission of solar gamma rays and neutrons is reviewed in the light of the recent solar activity in early August 1972. The gamma ray spectrometer on Orbiting Solar Observatory-7 (OSO-7) has observed the sun continuously for most of the activity period except for occultation by the earth. In association with the 2B flare on August 4, 1972, and the 3B flare on August 7, 1972, the monitor provides evidence for solar gamma ray line emission in the energy range from 300 keV

to 10 MeV. A summary of all the results available from preliminary analysis of the data will be given. Author

N74-21464* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NUCLEAR GAMMA RAYS FROM SOLAR FLARES c29
R. Ramaty and R. E. Lingenfelter (Calif. Univ., Los Angeles) *In its* High Energy Phenomena on the Sun 1973 p 301-314 refs (For availability see N74-21440 12-30)
CSCL 03B

The theory of gamma-ray line emission from solar flares is reviewed and revised. It is shown that the line emissions at 0.5, 2.2, 4.4, and 6.1 MeV are due to positron annihilation, deuterium deexcitation following neutron capture on hydrogen, and the deexcitation of excited states in carbon and oxygen. From the observed relative line intensities it is possible to determine the spectrum of accelerated protons in the flare region. This spectrum is found to be very similar to that of charged particles from the flare observed near earth. The total number of protons at the sun is deduced from the observed absolute line intensities for various interaction models. Author

N74-21465* Chicago Univ., Ill. Enrico Fermi Inst. and Dept. of Physics.
SOLAR FLARE ACCELERATED ISOTOPES OF HYDROGEN AND HELIUM c24
J. D. Anglin, W. F. Dietrich, and J. A. Simpson *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 315-340 refs (For availability see N74-21440 12-30)
(Grants NGL-14-001-006; NSF GA-28368X)
CSCL 03B

Measurements of solar flare hydrogen, deuterium, tritium, helium-3, and helium-4 in the energy range approximately 10 to 50 MeV per nucleon obtained with instrumentation on the IMP-4 and IMP-5 satellites are reported and studies based on these results which place several constraints on theories of solar flare particle acceleration are discussed. A brief review of previous work and the difficulties in studying the rare isotopes of hydrogen and helium is also included. Particular emphasis is placed on the fact that the information to be obtained from the solar flare products of high energy interactions is not available through either solar wind observations where both the acceleration mechanism and the coronal source of the nuclear species are different, or optical measurements of solar active regions. Author

N74-21466* California Inst. of Tech., Pasadena.
THE ISOTOPES OF H AND He IN SOLAR COSMIC RAYS c24
T. L. Garrard, E. C. Stone, and R. E. Vogt *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 341-354 refs (For availability see N74-21440 12-30)
(Contract NAS5-9312; Grant NGR-05-002-160)
CSCL 03B

The isotopic composition of H and He in solar cosmic rays was studied with the solar galactic cosmic ray experiment on the Orbiting Geophysical Observatory, OGO-6. Averaging over 20 days of data from seven flare events during 1969, the ratios He-3/-He-4 = 0.10 + or - 0.02, D/H (76) .0003 and T/H (76) .0001 in the 4 to 5 MeV/nucleon energy range were obtained. In addition, large variations were found in the relative abundance of He-3 from event of event, with a maximum ratio of He-3/He-4 = 0.26 + or - 0.08 observed on October 14 and 15, 1969. The relative abundance of He-3 and D during this event does not seem to be consistent with existing calculations of the nuclear interaction orgin of these isotopes. Author

N74-21467* Dartmouth Coll., Hanover, N.H. Radiophysics Lab.
MAGNETIC FIELD RECONNECTION AND PARTICLE ACCELERATION c24
B. U. O. Sonnerup *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 357-376 refs (For availability see N74-21440 12-30)
(Grant NGR-30-001-040)
CSCL 03B

After a brief review of steady state reconnection models, the processes are discussed which place an upper limit on the reconnection rate. In many applications the requirement that the width of the diffusion region exceed the ion gyroradius leads to a severe restriction on this limit. Unless the conductivity is much less than the value given by Spitzer's formula, solar flare times may result which are too long by a factor of 1000 or more. Turbulent and gyro effects which may lead to a reduced conductivity are shown to be operative, but only for sufficiently small ratios of plasma to magnetic pressure in the inflow. Particle energization processes associated with magnetic field reconnection and particle reflection by fast shocks are considered. These processes are effective as a first stage in the acceleration of charged particles, but additional multistep processes are needed to reach proton energies above a few MeV. Author

N74-21468* California Univ., Berkeley. Dept. of Physics.
COMPOSITION AND ENERGY SPECTRA OF SOLAR PARTICLES c24
P. B. Price *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 377-392 refs (For availability see N74-21440 12-30)
(Contract NAS9-12005; Grants NGR-05-003-376; NGL-05-002-410; Contract AT(04-3)-34)
CSCL 03B

Modern and ancient energetic particles emitted in solar flares are examined. Data cover particle composition and energy spectra. Author

N74-21469* Chicago Univ., Ill. Enrico Fermi Inst.
A MECHANISM FOR THE ABUNDANCE ENHANCEMENTS OF HEAVY NUCLEI IN SOLAR FLARE PARTICLE EVENTS c24
Brian G. Cartwright and Antonio Mogro-Campero *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 393-403 refs (For availability see N74-21440 12-30)
(Contract NAS5-9366; Grants NGL-14-001-006; NSF GA-28368X)
CSCL 03B

A mechanism is proposed to account for the recently reported abundance enhancements of heavy nuclei in solar flares. The mechanism requires two acceleration stages for its operation: First, fully stripped ions are accelerated to suprathermal energies, and subsequently, a fraction of these ions are Fermi accelerated to higher energies. It is shown that because injection into Fermi acceleration is rigidity dependent and the ions may pick up electrons during transport to the Fermi acceleration region, an enhancement of the abundances of heavy nuclei can occur. The degree of the enhancement depends on a number of factors particular to each flare, so that the degree of enhancement may be variable from flare to flare, or may be a function of time within a given flare. In some flares, conditions may be such that no enhancement would be expected. Author

N74-21470* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR COSMIC RAY MICRO-EVENTS c24
F. B. McDonald and M. A. VanHollebeke *In its* High Energy Phenomena on the Sun 1973 p 404-417 refs (For availability see N74-21440 12-30)
CSCL 03B

To study small discrete solar particle events, it has proven useful to define a special class such that the proton flux at energies greater than 20 MeV exceed 0.0001 protons/sq cm-sec-sr-MeV. These increases are termed microevents. An arbitrary upper limit is placed at 2 X 0.02 protons/sq cm-sec-sr-MeV. By demanding a measurable flux above 20 MeV, a better separation from corotating events is achieved and onset times can in general be determined more precisely. Over an observing period extending from May 1967 through December 1971, approximately 105 events were observed. There are several different sources of these small events. Some are produced by moderate to large solar flares near the east limb or by solar flares on the nonvisible disk of the sun. Others are produced by generally minor solar activity: typically in 1N flare, a group of type 3 radio bursts and a well defined X-ray burst. A significant number of this latter type are accompanied by type 2 radio emission. A small sample of the micro-events can be classified as scatter-free events. For these the distance traveled by the particles before their initial detection at earth is on the order of

1.5 AU and observed rise and decay times are much less than normal. Examples of these general types of micro-events and their solar association are discussed. Author

N74-21471* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MODULATION OF SOLAR COSMIC RAYS c29
L. A. Fisk *In its* High Energy Phenomena on the Sun 1973 p 418-438 refs (For availability see N74-21440 12-30)
CSCL 03B

Consideration is given to whether the modulation of low energy solar cosmic ray nuclei between the sun and earth can be so extreme that the fluxes observed at 1 AU imply (1) that the cosmic ray energy density in the solar atmosphere is comparable to the thermal energy density, and/or (2) that the cosmic ray intensity is sufficient in the solar atmosphere to produce detectable fluxes of secondary particles such as low energy positrons. It was found that such large modulation is compatible with observations, provided that the modulation occurrence is confined within a solar envelope lying within approximately 0.2 to 0.3 AU of the sun. There is, however, no compelling observational evidence to require that the modulation is this large. Author

N74-21472* Bell Telephone Labs., Inc., New York.
SOLAR FLARE ALPHA PARTICLES c24
L. J. Lanzerotti *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 427-438 refs (For availability see N74-21440 12-30)
CSCL 03B

Interplenetary disturbances frequently change the instantaneous values of the low energy solar flare alpha-to-proton flux ratios. The fluxes of alpha particles were integrated over the duration of seven large solar events occurring between May 28, 1967, and November 6, 1969, in order to investigate the total alpha particles fluxes observed at 1 AU resulting from the flares. The spectra of the event integrated alphas are always softer than the spectra of the event integrated protons. As a consequence, the event-integrated alpha-to-proton ratios decrease slightly with increasing energy per nucleon. The He-4/H-1 ratios averaged over the seven events are found to vary as 0.026 (E/nucl) sup -0.2 in the range 1 to 10 MeV/nucleon. The value of the ratio at 1 MeV/nucleon is less than the helium-to-hydrogen abundance determined from spectroscopic studies of prominences and the chromosphere, and is less than the average solar wind helium-to-hydrogen abundance. Author

N74-21473* California Univ., Berkeley. Space Sciences Lab.
THE RELATIONSHIP OF SOLAR FLARE ELECTRONS TO THE FLARE FLASH PHASE AND TYPE 3 RADIO BURSTS c27
R. P. Lin *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 439-449 refs (For availability see N74-21440 12-30)
(Contracts NAS5-11038; NAS9-10509; Grant NGL-05-003-017)
CSCL 03B

The energy spectrum and temporal behavior of the 10 to 100 keV solar flare electrons observed at 1 AU are interpreted in terms of: (1) the location of the acceleration region, (2) the time of acceleration and duration of the injection into the interplanetary medium, and (3) type 3 radio burst origin at the sun and at 1 AU. For at least some and possibly the majority of electron flare events the density of the acceleration region is approximately 2 X 10 to the 9th power cu/cm, the time of acceleration and release coincides to within minutes of the flash phase as indicated by the type 3 radio burst, and the duration of the release less than or approximately 3 minutes. Evidence for the origin of type 3 radio bursts in 10 to 100 keV electron streams is shown and discussed. Author

N74-21474* High Altitude Observatory, Boulder, Colo.
CORONAL MAGNETIC FIELDS AND ENERGETIC PARTICLES c24
Gordon Newkirk, Jr. *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 453-477 refs (For availability see N74-21440 12-30)
(Contract N00014-66-C-0239; NR Proj. 013-023)
CSCL 03B

An examination was made of magnetic field effects in coronal and interplanetary space on propagation and storage of energetic particles from the flare site to 1 AU. Attempts were made to determine how several characteristics of solar energetic particle emissions are influenced by detailed configuration of the corona magnetic fields below 2.5 solar radii. Solar energetic particles are followed in the ambient magnetic field from injection above a flare until they either: (1) impact on the photosphere, (2) escape into interplanetary space, or (3) mirrow at some distant location in the corona. Author

N74-21475* Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
A LOWER LIMIT TO THE ALTITUDE OF CORONAL PARTICLE STORAGE REGIONS DEDUCED FROM SOLAR PROTON ENERGY SPECTRA c24
S. M. Krimigis *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 478-485 refs (For availability see N74-21440 12-30)
(Contract N00017-72-C-4401)
CSCL 03B

The spectrum of low energy protons observed at 1 AU following solar flares shows little or no evidence of energy degradation down to approximately 0.3 MeV. Such observations may be used to set a lower limit on the altitude of hypothetical coronal particle storage regions, ranging from 2 to 7 R sub s. It is pointed out that closed coronal magnetic loop structures are observed to extend to $< 2R_s$, so that long-term storage of low energy protons does not take place in the immediate vicinity of the sun. It is further suggested that in the few cases where the proton spectrum appears to be degraded at low energies, the energy loss may be due to adiabatic deceleration in the expanding solar wind. The alternative of continual acceleration is suggested as a plausible substitute for the particle storage hypothesis. Author

N74-21476* New Hampshire Univ., Durham. Dept. of Physics.
CORONAL PROPAGATION OF ENERGETIC CHARGED PARTICLES c24
E. C. Roelof *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 486-502 refs (For availability see N74-21440 12-30)
(Contract F19628-73-C-0070; NOAA-03-3-022-41)
CSCL 03B

A technique for estimating the equatorial connection longitude of interplanetary field lines to the corona is applied to quasi-stationary low energy solar charged particle (LESP) events to reconstruct their coronal injection profile. Comparison with synoptic charts constructed from alpha chromospheric absorption features for solar rotation 1524 reveals that the inferred chromospheric equatorial magnetic neutral line structure strikingly orders the LESP coronal injection profiles of greater than or equal 0.3 MeV protons for this period (August 1967), allowing the identification of acceleration processes lasting several days and well defined coronal transport over greater than or approximately 100 deg. It is also proposed that LESP observations offer a unique tool for studying the magnetic structure of the transition region from the low corona to interplanetary space. Author

N74-21477* California Univ., Riverside. Dept. of Physics and Inst. of Geophysics and Planetary Physics.
ENERGETIC PARTICLE STORAGE ON THE SUN c24
G. M. Simnett *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 503-515 refs (For availability see N74-21440 12-30)
CSCL 03B

The storage of energetic electron and protons of energies much greater than 1 GeV in the solar corona is investigated. E.H.W.

N74-21478* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR RADIO BURSTS AT KILOMETER WAVELENGTHS c07
R. G. Stone and Joseph Fainberg *In its* High Energy Phenomena

on the Sun 1973 p 519-536 refs (For availability see N74-21440 12-30)
CSCL 03B

The potential value of traveling solar radio bursts for investigating energetic particle propagation, and for probing the interplanetary medium is discussed. A general survey of the characteristics of type 3 radio phenomena observed at hectometer and kilometer wavelengths is presented along with a brief discussion of the relationships among type 1 meter noise storms, decametric continuum, and type 3 hectometric storms. Type 3 bursts are analyzed to show how these data provide information about the average energy, dispersion, and trajectory of energetic particles, the interplanetary scale, and magnetic field configuration. The recent observations of type 2 shock wave phenomena at kilometer wavelengths are described, and current research and the direction of future observation are outlined. Author

N74-21479* Michigan Univ., Ann Arbor.
DECAY TIME OF TYPE 3 SOLAR BURSTS **c29**
Hector Alvarez and F. T. Haddock *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 537-539 refs (For availability see N74-21440 12-30)
CSCL 03B

Type 3 solar bursts observed by OGO-5, below 600 kHz, were analyzed. Decay times were measured, and collisional decay times were computed for distances out to 1 AU. By fitting power functions to the computed and observed decay times, and using local plasma hypothesis, it was found that the ratio rho of computed observed values varies with heliocentric radial distance according to a power function rho = 3r to the 0.7th power, assuming fundamental emission, and rho = 2r to the 0.7th power, assuming second harmonic emission. Author

N74-21480* Maryland Univ., College Park. Clark Lake Radio Observatory.
ON THE DENSITY OF THE CORONA IN REGIONS OF TYPE 3 ACTIVITY **c29**
T. B. H. Kuiper *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 540-551 refs (For availability see N74-21440 12-30)
(Grants NGR-21-002-029; NSF GP-19401)
CSCL 03B

The east-west positions of 190 type 3 bursts were measured between 30 and 65 MHz with the log-periodic array at Clark Lake. A method is described to find the intrinsic variation of position with frequency of type 3 bursts based on the comparison of the positions of the bursts measured at any two arbitrary frequencies. It is found that the variation of position frequency agrees with the behaviour expected from coronal density models. This suggests that the measured positions were not seriously affected by scattering in the corona. Knowing the functional form of the variation of position with frequency for type 3 bursts, it is shown that the observed burst positions can be corrected for the effects of ionospheric refraction. Author

N74-21481* Martin Marietta Corp., Denver, Colo.
A STORM OF TYPE 3 BURSTS OBSERVED BY RAE-1 IN AUGUST 1968 **c29**
Edward G. Howard *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 552-557 refs (For availability see N74-21440 12-30)
CSCL 03B

Curves of the number of type 3 bursts as a function of time are presented for six fixed frequencies (2.8, 1.65, 1.31, 0.995, 0.700, and 0.54 MHz). The curves peak at approximately 0500 UT August 20, 1968, and are symmetrical on both sides. Sakurai (1971) has shown that this time correlates well with the CMP of the McMath Region 9597. The maximum rate of bursts is approximately 150 per hour at the higher frequency of 2.8 MHz. Over 20,000 bursts were counted during the 15-day period from August 13 to August 27 when the active region was visible to the earth. A least-squares normal curve has been fitted to the observational data and calculations of variance and standard deviation are given. Author

N74-21482* High Altitude Observatory, Boulder, Colo.
TYPE 2 AND TYPE 3 BURST THEORY **c29**
Dean F. Smith *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 558-572 refs (For availability see N74-21440 12-30)
CSCL 03B

The present state of the theory of type 3 bursts is reviewed by dividing the problem into the exciting agency, radiation source, and propagation of radiation between the source and the observer. In-situ measurements indicate that the excitors are electron streams of energy about 40 keV which are continuously relaxing. An investigation of neutralization of an electron stream indicates that n sub s is much less than 100,000 n sub e, where n sub s is the stream density and n sub e the coronal electron density. In situ observations are consistent with this result. An analysis of propagation of electrons in the current sheets of coronal streamers shows that such propagation at heights greater than 1 solar radius is impossible. The mechanisms for radiation are reviewed; it is shown that fundamental radiation at high frequencies (approximately 100 MHz) is highly beamed in the radial direction and that near the earth second harmonic radiation must be dominant. Because of beaming of the fundamental at high frequencies, it can often be quite weak near the limb so that the second harmonic is dominant. In considering propagation to the observer, the results of scattering of radiation are discussed. The present state of the theory of type 2 bursts is reviewed in the same manner as type 3 bursts. Author

N74-21483* Tokyo Univ. (Japan). Dept. of Astronomy.
TIME PROFILE OF TYPE 3 BURSTS IN DECAMETER AND HECTOMETER RANGE **c29**
Tatsuo Takakura, Yoshiharu Naito, and Kenichiro Ohki (Tokyo Astron. Obs.) *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 573-576 (For availability see N74-21440 12-30)
CSCL 03B

The following new hypothesis is proposed. The decay time of plasma waves is much shorter than the time scale of type 3 bursts especially at low frequencies. Accordingly, the time variation of radio flux at a given frequency merely corresponds to the flux of fast electrons passing through the corresponding plasma layer. Author

N74-21484* High Altitude Observatory, Boulder, Colo.
FLARE-INDUCED MHD DISTURBANCES IN THE CORONA - MORETON WAVES AND TYPE 2 SHOCKS **c29**
Yutaka Uchida (Tokyo Astron. Obs.) *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 577-588 refs (For availability see N74-21440 12-30)
CSCL 03B

The propagation in the corona of the magnetohydrodynamic (MHD) disturbance possibly emitted at the explosive stage in the initial phase of a flare is considered. The behavior of the MHD fast-mode wavefront, whose source is located at the flare, is calculated by using eiconal-characteristic method in the High Altitude Observatory (HAO) realistic models of coronal magnetic field and density for the days of some particular flare events. It is shown as the result that the peculiar behavior of Moreton's surface wave and the peculiar appearance in the shape and position of the type 2 burst sources can be consistently understood by considering the refraction, focussing, and formation of shocks of MHD fast-mode disturbance in the actual distribution of Alfven velocity in the corona. Moreton waves seem to appear only when the flare explosion happens to occur at the edge of an active region and faces a low-Alfven-velocity region lying on the surface. The wave, which is initially emitted isotropically is refracted into a direction in which the condition for down-refraction holds to allow chromospheric reentrance of disturbance. Author

N74-21485* Commonwealth Scientific and Industrial Research Organization, Sydney (Australia). Div. Of Radiophysics.
REGULAR PULSATIONS FROM THE SOLAR CORONA **c29**
J. P. Wild *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 589-593 refs (For availability see N74-21440 12-30)
CSCL 03B

Meter-wave pulsations observed at Culgoora are discussed. The characteristics of recorded pulsation events are summarized. F.O.S.

N74-21486* Los Alamos Scientific Lab., N.Mex.
THE POSITION AND SIZE OF RADIO SOURCES ASSOCIATED WITH SOLAR ELECTRON EVENTS c07
I. D. Palmer and R. P. Lin (Calif. Univ., Berkeley) *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 594-601 refs Sponsored in part by AEC (For availability see N74-21440 12-30)
(Grant NGL-05-003-017)
CSCL 03B

The positions and sizes of the sources of type 3 bursts which are associated with interplanetary electron events (> 45 keV) are observed by the 80-MHz Culgoora radioheliograph. The sizes of the responsible electron streams at 0.6 solar radius in the corona are much smaller than the cones of propagation of the electrons in interplanetary space. Many of the type 3 bursts are shown to be accompanied by a type 5 continuum, and it is argued that the observation of a type 3 to 5 radio burst implies an increased spreading of electrons at heights > 0.6 solar radius, consistent with the extent of the propagation cone of the electrons in interplanetary space.
Author

N74-21487* Observatoire de Paris-Meudon (France).
HIGH SENSITIVITY SPECTRAL OBSERVATIONS IN THE DECAMETRIC RANGE c07
Jerome DeLaNoe, Andre Boischot, and Monique Aubier *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 602-609 refs (For availability see N74-21440 12-30)
CSCL 03B

High resolution dynamic spectra of solar emissions in the range 80 to 20 MHz are discussed. The major features of observations described are (1) decametric storms, (2) type 3 bursts, and (3) time profile of type 3 bursts.
F.O.S.

N74-21488* Observatoire de Paris-Meudon (France).
A HIGH RESOLUTION STUDY IN TIME, POSITION, INTENSITY, AND FREQUENCY OF A RADIO EVENT ON 14 JANUARY 1971 c07
C. Caroubalos, M. Pick (Sterrewacht Sonnenborgh, Utrecht), H. Rosenberg, and C. Slottje *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 610-614 refs (For availability see N74-21440 12-30)
CSCL 03B

High resolution position and spectrum measurements were made of a complex solar radio activity on January 14, 1971, from 1120 to 1130 UT. Positions were measured with 169 MHz Nancay E-W Radioheliograph, while dynamic spectra and polarization were observed with the 60-channel radiospectrograph of Nera. The radio event consisted of two closely similar groups of type 3 bursts and type 2-like details, and a stationary type 4 continuum, including some very clear pulsating structures. The general aspect of this activity is presented.
Author

N74-21489* Commissariat a l'Energie Atomique, Saclay (France). Service d'Electronique Physique.
THE CHROMOSPHERIC ASSOCIATION OF THE METRIC TYPE 3 BURSTS - IMPLICATIONS CONCERNING THE ACCELERATION OF SOLAR ELECTRONS AND THE ACTIVE STREAMERS c29
F. Axisa, M. J. Martres (Obs. de Paris-Meudon), M. Pick (Obs. de Paris-Meudon), and I. Soru-Escaut (Obs. de Paris-Meudon) *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 615-622 refs (For availability see N74-21440 12-30)
CSCL 03B

In two recent papers it was shown that the metric type 3 emission is closely related to a transient perturbation seen in absorption in the H alpha line. In addition, this perturbation sometimes triggers a flare, sometimes not. This can explain why the type 3 have a poor H alpha flare correlation rate and still are a typical flash phase emission when flare-associated. The characteristics are summarized of the new association proposed. It is assumed that 10 to 100 keV electrons are accelerated in connection with a particular kind of transient H alpha absorbing feature. For as yet undetermined reasons, this process would often, but not always, result in a more efficient acceleration coincident with the early phase of the optical flare. The possibilities that this process could lead occasionally to long lasting subrelativistic particle emissive region are explored.
Author

N74-21490* Colorado Univ., Boulder. Dept. of Astro-Geophysics.
HIGH ENERGY PHENOMENA ON THE SUN SYMPOSIUM - SUMMARY AND OUTLOOK c29
James W. Warwick *In* NASA, Washington High Energy Phenomena on the Sun 1973 p 625-630 (For availability see N74-21440 12-30)
CSCL 03B

A brief summary of the symposium is presented along with an outlook for developments in solar physics.
F.O.S.

N74-21491*# Martin Marietta Corp., Denver, Colo.
BALLISTIC MODE MERCURY ORBITER MISSION OPPORTUNITY HANDBOOK EXTENSION Final Report
G. R. Hollenbeck, P. S. Lewis, and P. C. Rockenbach Washington NASA Mar. 1974 134 p
(Contract NAS2-7268)
(NASA-CR-2385) Avail: NTIS HC $4.75 CSCL 22A

Interplanetary trajectory characteristics are presented, for Venus swingbys to Mercury, where multiple revolutions about the Sun are permitted. Additional consideration is given to the use of multiple Venus swingbys and/or to midcourse, near perilhelion, propulsive maneuvers to improve the performance of the mission as measured in terms of payload in Mercury orbit. Missions in 1980, 1983, 1985 and 1983 were analyzed with navigation results also developed. An exploratory investigation established the availability of low energy mission opportunities in 1991, 1994, 1996 and 1999.
Author

N74-21492# Joint Inst. for Lab. Astrophysics, Boulder, Colo.
TRANSFER OF RADIATION IN SPECTRAL LINES
V. V. Ivanov Nov. 1973 480 p refs Transl. into ENGLISH of the book "Radiative Transfer and the Spectra of Celestial Bodies" Leningrad, Dec. 1971 Prepared in cooperation with Colo. Univ., Boulder
(NBS-SP-385; LC-73-600273) Avail: SOD HC $7.45 as C13.10:385 CSCL 03B

The transfer of radiant energy through a gas composed of atoms with two discrete levels is discussed. Although the emphasis is on analytical methods, extensive numerical and graphical results are presented.
Author

N74-21493*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE MANY FACES OF MARS
Dec. 1973 56 p
(Contract NAS7-100)
(NASA-CR-137432; JPL-TM-33-654) Avail: NTIS HC $3.75 CSCL 03B

The Mariner Mars 1971 spacecraft was the first to orbit another planet. For 349 days, it transmitted a vast amount of data, including 7300 television pictures, gathered by its five scientific instruments. This memorandum presents some of the findings on the characteristics of the surface, atmosphere, and satellites of Mars. Included are photographs of the surface, atmosphere, satellites, surface maps, and spectrometric data for the atmosphere.
Author

N74-21494*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DEEP SPACE NETWORK Progress Report, Jan. - Feb. 1974
15 Apr. 1974 201 p refs
(Contract NAS7-100)
(NASA-CR-138077; JPL-PR-42-20) Avail: NTIS HC $13.25 CSCL 20D

The objectives, functions, and organization of the Deep Space Network are summarized. The Deep Space Instrumentation Facility, the Ground Communications Facility, and the Network Control System are described.
Author

N74-21495*# National Aeronautics and Space Administration, Washington, D.C.
SKYLAB EXPERIMENTS. VOLUME 3: MATERIALS SCIENCE

May 1973 59 p refs Prepared in cooperation with Colo. Univ.
(NASA-EP-112-Vol-3) Avail: NTIS MF $1.45; SOD HC $1.05 CSCL 22C

The materials science and technology investigation conducted on the Skylab vehicle are discussed. The thirteen experiments that support these investigations have been planned to evaluate the effect of a weightless environment on melting and resolidification of a variety of metals and semiconductor crystals, and on combustion of solid flammable materials. A glossary of terms which define the space activities and a bibliography of related data are presented. Author

N74-21496*# National Aeronautics and Space Administration, Washington, D.C.
SKYLAB EXPERIMENTS. VOLUME 5: ASTRONOMY AND SPACE PHYSICS
May 1973 84 p Prepared in cooperation with Colo. Univ.
(NASA-EP-114-Vol-5) Avail: NTIS MF $1.45; SOD HC $1.20 CSCL 22C

The astronomy and space physics investigations conducted in the Skylab program include over 20 experiments in four categories to explore space phenomena that cannot be observed from earth. The categories of space research are as follows: (1) phenomena within the solar system, such as the effect of solar energy on Earth's atmosphere, the composition of interplanetary space, the possibility of an inner planet, and the X-ray radiation from Jupiter, (2) analysis of energetic particles such as cosmic rays and neutrons in the near-earth space, (3) stellar and galactic astronomy, and (4) self-induced environment surrounding the Skylab spacecraft. Author

N74-21497*# National Aeronautics and Space Administration, Washington, D.C.
SKYLAB EXPERIMENTS. VOLUME 6: MECHANICS
May 1973 40 p refs Prepared in cooperation with Colo. Univ.
(NASA-EP-115-Vol-6) Avail: NTIS MF $1.45; SOD HC $0.85 CSCL 22C

Skylab program activities are presented in a form adapted to instruction of high school students. The overall goals of the program are discussed. The specific accomplishments of the mechanics investigations are described. The subjects involved are as follows: (1) evaluation of mobility aids, (2) mass measurement devices, and (3) space guidance crew/vehicle disturbances. Author

N74-21498*# National Aeronautics and Space Administration, Washington, D.C.
SKYLAB EXPERIMENTS. VOLUME 7: LIVING AND WORKING IN SPACE
May 1973 48 p refs Prepared in cooperation with Colo. Univ.
(NASA-EP-116-Vol-7) Avail: NTIS MF $1.45; SOD HC $0.90 CSCL 22C

Experiments conducted on the Skylab vehicle that will measure and evaluate the ability of the crew to live and work effectively in space are discussed. The methods and techniques of human engineering as they relate to the design and evaluation of work spaces, requirements, and tools are described. The application of these methods and the Skylab measurements to the design of future spacecraft are analyzed. Author

N74-21499*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
FILTERING THEORY APPLIED TO ORBIT DETERMINATION
Vicente Torroglosa Dec. 1973 61 p refs Sponsored in part by ESRO
(NASA-TM-X-70620; X-582-73-379) Avail: NTIS HC $6.25 CSCL 22C

Modifications to the extended Kalman filter and the Jazwinski filter are made and compared with the classical extended Kalman filter in applications to orbit determination using real data. The results show that with the kind of data available today, the application of filtering theories in this field presents many problems. Author

N74-21500*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
REPORT ON THE ALPO LTP OBSERVING PROGRAM
Winifred Sawtell Cameron Mar. 1974 28 p refs Submitted for publication
(NASA-TM-X-70625; X-601-74-86) Avail: NTIS HC $4.50 CSCL 03A

Observations of lunar transient phenomena for the Association of Lunar and Planetary Observers (ALPO) are reported. The procedures for making visual observations for estimating albedo are described, and the reported albedo analyzed for lunar topographic features. It is shown that a catalog or scale of albedos can be established for each feature. F.O.S.

N74-21501*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
IMPMOT USER'S MANUAL
D. J. Stewart and M. J. Bishop (Computer Sci. Corp.) Apr. 1974 92 p refs
(NASA-TM-X-70626; X-580-74-87) HC $7.75 CSCL 22A

This user's manual describes the input and output variables as well as the job control language necessary to utilize the IMP-H apogee motor firing program, IMPMOT. The IMPMOT program can be executed as either a stand-alone program or as a member of the flight dynamics system. This program is used to determine the time and attitude at which to fire the IMP-H apogee boost motor. The IMPMOT program is written in FORTRAN 4 for use on the IBM 360 series computer. Author

N74-21502# Osservatorio Astronomico, Rome (Italy).
DETERMINATION OF THE PHOTOMETRIC CONTRAST AND MEDIUM PHOTOSPHERIC GRANULATION DIMENSIONS USING A PHOTOGRAPHIC METHOD [DETERMINAZIONE DEL CONTRASTO FOTOMETRICO E DELLE DIMENSIONI MEDIE DELLA GRANULAZIONE FOTOSFERICA MEDIANTE METODO FOTOGRAFICO]
Vincenzo Croce Aug. 1973 14 p refs In ITALIAN
(RR-8) Avail: NTIS HC $4.00

A photographic method for the statistical determination of the photometric and spatial characteristics of an image of granulated reticle was applied to solar photosphere analysis. Two tests are described which demonstrate the possibility of extracting the degradation factor of the photographic images of the photosphere granulation. The sensitivity of the method was determined. ESRO

N74-21503# Royal Aircraft Establishment, Farnborough (England).
ANALYSIS OF 24 ORBITS TO DETERMINE ODD ZONAL HARMONICS IN THE GEOPOTENTIAL
D. G. King-Hele and G. E. Cook Jun. 1973 13 p refs Presented at the 1st Intern. Symp. on the Use of Artificial Satellites for Geodesy and Geodyn., Athens, May 1973
(RAE-TM-SPACE-198; BR36386) Avail: NTIS HC $4.00

Values of the odd zonal harmonics in the geopotential are best obtained by analysis of the eccentricity variations of satellite orbits well distributed in inclination. Accurate orbits over a cycle of the argument of perigee were obtained for Cosmos 44 at inclination 65.1 deg and Cosmos 248 (i = 62.2 deg), after three years of observations with the Hewitt cameras. These orbits were used, together with those of Explorer 32 (i = 64.7 deg), GEOS 2, Peole, and 19 other satellites to make a new determination of the odd zonal harmonic coefficients. More than 100 sets of coefficients to fit the data were studied, and it is concluded that the omission of selected coefficients offers considerable advantages. Author (ESRO)

N74-21504# Royal Aircraft Establishment, Farnborough (England).
ANALYSIS OF THE ORBIT OF COSMOS 387 (1970-IIIA) NEAR 15TH-ORDER RESONANCE
D. G. King-Hele Sep. 1973 31 p refs
(RAE-TR-73132; BR36976) Avail: NTIS HC $4.75

The orbit of Cosmos 387 was determined with the aid of the RAE orbit refinement program PROP at 19 epochs between May 1971 and June 1972, using 1500 optical and radar observations. The average accuracy was about 70 m in perigee height and 0.001 deg. in inclination. The variation of orbital

inclination while the satellite was experiencing 15th-order resonance was analyzed to obtain equations accurate to 4% for the geopotential coefficients of order 15 and odd degree. These equations have subsequently been used in determining individual coefficients of order 15 and odd degree. The variation of eccentricity with argument of perigee showed unexpected complexity, including a tight loop near resonance. Analysis of the variation in eccentricity yielded accurate equations for the geopotential coefficients of order 15 and even degree., thus opening the way to the evaluation of individual coefficients of this type. The variations in the argument of perigee and right ascension of the node were also analyzed. Author (ESRO)

N74-21505*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
EFFECTS OF INTERPLANETARY SHOCK WAVES ON ENERGETIC CHARGED PARTICLES Progress Report
E. T. Sarris and J. A. VanAllen Jan. 1974 76 p refs
(Grant NGL-16-001-002; Contract N00014-68-A-0196-0003) (NASA-CR-137391; AD-773935; U-of-Iowa-74-4) Avail: NTIS HC $7.00 CSCL 04/1

The influence of interplanetary shock waves on energetic charged particles is studied in this work. Emphasis is given to the acceleration of protons in almost perpendicular shock waves (the angle psi between the shock normal and the upstream magnetic field being greater than about 80 degrees). The special case of protons accelerated in ideal perpendicular shock waves is treated analytically. (Modified author abstract) GRA

N74-21506# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
CELESTIAL INFRARED CALIBRATION SOURCES IN THE 8-14 MICROMETER REGION: VENUS AND JUPITER
Thomas E. Cecil, John W. Salisbury, Lloyd M. Logan, and Graham R. Hunt 5 Sep. 1973 17 p refs
(AD-772660; AFCRL-TR-73-0559; AFCRL-PSRP-562) Avail: NTIS CSCL 03/2

Venus and Jupiter are often used as long wavelength infrared (LWIR) calibration sources. The authors have reviewed the literature on radiometric and spectrometric measurements of these two planets and adopted reasonable brightness temperatures and spectral dependencies for their thermal radiation. Using these data, irradiance coefficients that can be used to determine the irradiance reaching the earth from these planets at any time were calculated. A crucial factor in the utility of these planets as calibration sources is the constancy with which they radiate in the infrared. The authors conclude that Jupiter may be a variable source. Venus, on the other hand, appears to be generally quite constant, but brief temporal variations may take place. (Modified author abstract) GRA

N74-21507# Aerospace Corp., El Segundo, Calif. Lab. Operations.
NGC 1068: 3-mm RADIO VARIABILITY Technical Report, Dec. 1966 - Aug. 1973
William G. Fogarty, Eugene E. Epstein, John W. Montgomery, and John Mottman 7 Dec. 1973 20 p refs
(Contract F04701-73-C-0074)
(AD-772716; TR-0074(9230-03)-4; SAMSO-TR-73-388) Avail: NTIS CSCL 03/2

Recent measurements of the 3.3-mm flux density of the Seyfert galaxy NGC 1068 indicate a detection approximately 4 standard deviations above the value implied by an extrapolation of the longer wavelength radio data. This result, plus our two previously reported detections, together with the fact that over 7 years most of our observations are consistent with the extrapolated flux value, imply that the 3-mm flux of NGC 1068 may be variable. A standard statistical test indicates an approximately 0.1 percent significance for the hypothesis that the flux is constant. Author (GRA)

N74-21508# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN INVESTIGATION OF MINIMUM TIME, LAUNCH-TO-RENDEZVOUS TRAJECTORIES M.S. Thesis
Steven H. Edelman Dec. 1973 71 p refs
(AD-774429; GA/MC/73A-2) Avail: NTIS CSCL 22/3

Minimum time trajectories between the surface of the earth and a 270 statute mile circular orbit, generated with the assumption of impulsive thrusting, are used to determine minimum time-to-rendezvous with a target in the specified orbit. The amount of impulse is fixed by specifying the ratio of the launch vehicle's final to initial masses. The study is divided into two principal phases. In the orbit injection portion of the study, a set of minimum time orbit injection trajectories, subject to certain launch constraints, is generated by the solution of a fourth order polynomial for various range angles. The effect on the number of admissible trajectories of changing the mass ratio is also investigated. During the rendezvous phase of the study, the generated set of trajectories is used to determine a window for direct launch to rendezvous. (Modified author abstract) GRA

N74-21509# Lincoln Lab., Mass. Inst. of Tech., Lexington.
PERTURBATION OF A SYNCHRONOUS SATELLITE DUE TO GEOPOTENTIAL
Sushanta Srivastava 1 Feb. 1974 30 p refs
(Contract F19628-73-C-0002; AF Proj. 649L)
(AD-774548; TN-1974-8; ESD-TR-74-18) Avail: NTIS CSCL 22/3

The note summarizes the secular perturbation of a synchronous satellite orbit due to geopotential. The effect of eccentricity and inclination of the orbit is taken into account. It is shown that the secular perturbation of a synchronous satellite like LES-8/9 in the ecliptic plane is about 8 percent smaller than a geostationary satellite. Author (GRA)

N74-21510# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
GEOPHYSICS AND SPACE DATA BULLETIN, VOLUME 10, NUMBER 3, THIRD QUARTER 1973 Special Reports, Jul. - Sep. 1973
Anne L. Carrigan Nov. 1973 294 p refs
(AF Proj. 8666)
(AD-774410; AFCRL-TR-73-0607; AFCRL-SR-169) Avail: NTIS CSCL 03/2

The bulletin is a quarterly publication that contains AFCRL contract and inhouse data reported from sites throughout the world. The following types of data are contained within each issue: magnetometer, cosmic ray, ELF noise, riometer, solar optical and radio emission, and ionosonde. This issue covers such data for July, August, and December 1973. (Modified author abstract) GRA

N74-21511# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
DIFFERENTIAL GAME BARRIERS FOR TWO SPACECRAFT ENGAGED IN A PURSUIT-EVASION GAME IN ORBIT Ph.D. Thesis
Victor W. Grazier Dec. 1973 84 p refs
(AD-774395; GA/MC/73A-3) Avail: NTIS CSCL 15/7

The study searches for the differential game barrier for two spacecraft engaged in a pursuit-evasion game in orbit. By linearizing the equations of motion, a set of linear state equations is developed which, along with the non-linear state equations, is used to generate trajectories backward from the terminal surface. The trajectories for the linear and non-linear equations are then compared for equivalence and also used to provide necessary information on the barrier itself. Once the barrier has been determined, a method is developed theoretically to evaluate the location of a given starting point as to whether it lies in the escape zone or in the capture zone. The computer programs used in this study are included in the appendix for future research in this area. Author (GRA)

N74-20968 Joint Publications Research Service, Arlington, Va.
MANNED SPACE STATIONS IN CIRCUMTERRESTRIAL ORBITS
A. I. Rudev and V. G. Emin *In its* Legal Aspects of Manned Spaceflight and Remote Sensing of the Environment (JPRS-61614) 29 Mar. 1974 p 1-10 refs Transl. into ENGLISH from Sov. Gosudarstvo i Pravo (Moscow), no. 4, 1972 p 111-115 (For availability see N74-20967 12-13)

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also; 28 Propulsion Systems; and 32 Structural Mechanics.

N74-21512* National Aeronautics and Space Administration, Washington, D.C.
FIRST GEOSYNCHRONOUS WEATHER SATELLITE PREPARED FOR LAUNCH
8 May 1974 11 p
(NASA-News-Release-74-95) Avail: NASA Scientific and Technical Information Facility, P. O. Box 33, College Park, Maryland 20740 CSCL 22B

The Synchronous Meteorological Satellite (SMS), which is scheduled for launch 16 May 1974 is described along with the data transmission system. The Carrier Balloon System is discussed. The primary type of data to be obtained in conjunction with SMS and Nimbus F are meteorological, oceanographic, seismic, and tsunami information. The Space Environment Monitoring System is also described. F.O.S.

N74-21513 Purdue Univ., Lafayette, Ind.
SIGNAL DESIGN FOR A SATELLITE DATA COLLECTION SYSTEM Ph.D. Thesis
W. D. Lyle, Jr. 1973 129 p
Avail: Univ. Microfilms Order No. 74-5006

The design of a large set of waveforms for use in a satellite data collection system is studied. Subsets of waveforms from this set are assigned to various data collection platforms for use as codewords. The platforms, located on or near the earth's surface, transmit their data in coded form in short bursts periodically on a one-way communication link with the orbiting satellite. Each platform operates independently of all other platforms, and all platforms are assigned the same nominal carrier frequency. The waveforms set is designed to meet the conditions: (1) the waveforms are easy to generate by the platforms; (2) all waveforms in the set occupy the same frequency spectra; (3) the number of waveforms in the set is practically unlimited; (4) the waveforms have good correlation properties; small cross-correlation values and small out-of-phase autocorrelation values. Dissert. Abstr.

N74-21514 Stanford Univ., Calif.
EXPLICIT ATTITUDE STABILITY CRITERIA FOR PASSIVE, EARTH-POINTING SATELLITES Ph.D. Thesis
John Richard Murphy 1973 101 p
Avail: Univ. Microfilms Order No. 74-6519

A method is developed for constructing stability criteria applicable to earth-pointing motions of elastic, dissipative satellites possessing a finite number of degrees of freedom. The method is explicit in the sense that it leads to inequalities formulated entirely in terms of readily available quantities. In addition, explicit conditions which guarantee pervasive damping are stated. This makes it possible to establish instability or asymptotic stability with relative ease. To illustrate and test the procedures under consideration, the method is applied to three specific satellite configurations. A numerical counterpart to the analytic procedure, applicable to systems with many degrees of freedom, is presented in the form of a computer program and is applied to one of the illustrative examples. Dissert. Abstr.

N74-21515 North Carolina State Univ., Raleigh.
CHARACTERISTICS OF COUPLED NONGRAY RADIATING GAS FLOWS WITH ABLATION PRODUCT EFFECTS ABOUT BLUNT BODIES DURING PLANETARY ENTRIES Ph.D. Thesis
Kenneth Sutton 1973 180 p
Avail: Univ. Microfilms Order No. 74-5481

A computational method is developed for the fully-coupled solution of nongray, radiating gas flows with ablation product effects about blunt bodies during planetary entries. The treatment of radiation accounts for molecular band, continuum, and atomic line transitions with a detailed frequency dependence of the absorption coefficient. The ablation of the entry body is solved as part of the solution for a steady-state ablation process. Application of the developed method is shown by results at typical conditions for unmanned, scientific probes during entry to Venus. The radiative heating rates along the downstream region of the body can, under certain conditions, exceed the stagnation point value. The radiative heating to the body is attenuated in the boundary layer at the downstream region of the body as well as at the stagnation point of the body. Dissert. Abstr.

N74-21516*# National Aeronautics and Space Administration, Washington, D.C.
APOLLO PROGRAM FLIGHT SUMMARY REPORT: APOLLO MISSIONS AS-201 THROUGH APOLLO 16, REVISION 11
J. K. Holcomb Jun. 1972 132 p Revised
(NASA-TM-X-70154) Avail: NTIS HC $9.75 CSCL 22C

A summary of the Apollo flights from AS-201 through Apollo 16 is presented. The following subjects are discussed for each flight: (1) mission primary objectives, (2) principle objectives of the launch vehicle and spacecraft, (3) secondary objectives of the launch vehicle and spacecraft, (4) unusual features of the mission, (5) general information on the spacecraft and launch vehicle, (6) space vehicle and pre-launch data, and (7) recovery data. Author

N74-21517*# Missouri Univ., Rolla. Dept. of Electrical Engineering.
NUTATION CONTROL DURING PRECESSION OF A SPIN-STABILIZED SPACECRAFT Semiannual Status Report
Javin M. Taylor and Richard J. Donner Dec. 1973 64 p refs Submitted for publication
(Grant NGR-26-003-069)
(NASA-CR-138997; CRL-73-6) Avail: NTIS HC $6.25 CSCL 22B

The effects of precession thrust pulses and energy dissipation upon nutation of a spin-stabilized spacecraft are studied. Methods for controlling nutation during a precession maneuver are proposed and examined. A precession modulation control law is developed which uses precession thrust pulses to control nutation. Digital simulations show that precession control with separate nutation control is the fastest precessing system; however, the precession modulation method is only fractionally slower while not requiring a separate nutation control system. Author

N74-21518*# North American Rockwell Corp., Downey, Calif. Space Div.
DESIGN AND SYSTEMS ANALYSIS OF A CHEMICAL INTERORBITAL SHUTTLE. VOLUME 1: EXECUTIVE SUMMARY Final Report, 1 Jul. 1971 - 15 May 1972
W. Nissim May 1972 76 p refs
(Contract NAS8-27670)
(NASA-CR-120190; SD72-SA0042-1) Avail: NTIS HC $7.00 CSCL 22B

An interorbital shuttle that can be utilized to carry payloads between low earth orbit (180 n mi, 37.6 deg) and lunar or geosynchronous orbits, and also to interplanetary trajectories is discussed. After each mission the stage returns to its earth parking orbit where it delivers the inbound payloads, and where it is maintained and refueled for the subsequent missions. The stage can also be utilized to carry large payloads (150 to 200 KLBS) to the Space Station orbit (270 n mi, 55 deg) when it is used as a second or parallel burn stage to the space shuttle booster. The mission and systems analysis, as well as the results of structural, mechanical and propulsion, and avionics subsystems analysis and design are described. A development plan and cost estimates are also included. Author

N74-21519# Joint Publications Research Service, Arlington, Va.
AUTOMATIC FLIGHT CONTROL DEVICES ON THE FIRST SOVIET ROCKETS
B. Raushenbakh 24 Apr. 1974 7 p Transl. into ENGLISH from Aviats. i Kosmonavt. (Moscow), no. 3, Mar. 1974 p 44-45
(JPRS-61838) Avail: NTIS HC $4.00

A brief history is presented of the development of automatic flight control systems. Author

N74-21520*# Chrysler Corp., New Orleans, La. Space Div.
RESULTS OF THE 0.015 SCALE SPACE SHUTTLE VEHICLE ORBITER TEST (OA17) IN THE NASA LOW TURBULENCE PRESSURE TUNNEL
M. D. Milam (Rockwell Intern., Downey, Calif.) and M. T. Petrozzi (Rockwell Intern., Downey, Calif.) Feb. 1974 862 p
(Contract NAS9-13247)
(NASA-CR-134079; DMS-DR-2058) Avail: NTIS HC $46.25 CSCL 22B

Experimental aerodynamic investigations were conducted on a 0.015 scale model of the Space Shuttle Orbiter in a low turbulence pressure tunnel. Six component static aerodynamic force and moment data were recorded while the model was pitched from -2 deg to +26 deg angle of attack. The yaw angles during these pitch sweeps were 0 deg, -5 deg, and 7 1/2 deg. Base, sting cavity, vertical tail, wing trailing edge, and elevon pressures, as well as elevon and rudder hinge moment data were also obtained. The tests were conducted at a nominal Mach number of 0.25. The Reynolds number was varied throughout the test program from 2.5 million to 4.7 million to 10.0 million to 12.5 million. Author

N74-21521*# Chrysler Corp., New Orleans, La. Space Div.
FLUTTER TESTS (IS4) OF THE 0.0125-SCALE SHUTTLE REFLECTION PLANE MODEL 30-OTS IN THE LANGLEY RESEARCH CENTER 26-INCH TRANSONIC BLOWDOWN TUNNEL TEST NO. 547
Michael A. Kotch (Rockwell Internatl., Downey, Calif.) Apr. 1974 72 p
(Contract NAS9-13247)
(NASA-CR-134092; DMS-DR-2146) Avail: NTIS HC $6.75 CSCL 22B

A series of slab wing flutter models with rigid orbiter fuselage, external tank, and SRB models of the space shuttle were tested, in a reflection plane arrangement, in the NASA Langley Research Center's 26-inch Transonic Blowdown Tunnel. Model flutter boundaries were obtained for both a wing-alone configuration and a wing-with-orbiter, tank and SRB configuration. Additional test points were taken of the wing-with-orbiter configuration, as a correlation with the wing-alone condition. A description of the wind tunnel models and test procedures utilized in the experiment are provided. Author

N74-21522*# Chrysler Corp., New Orleans, La. Space Div.
WIND TUNNEL TEST RESULTS OF FAIRINGS ON A .004 SCALE MODEL ROCKWELL SPACE SHUTTLE INTEGRATED VEHICLE AERODYNAMIC CHARACTERISTICS AT MACH NUMBERS FROM 0.6 TO 4.96 (IA62F)
Ed Allen (Rockwell Intern., Downey, Calif.) and Tom Hamilton (Rockwell Intern., Downey, Calif.) Apr. 1974 152 p
(Contract NAS9-13247)
(NASA-CR-134094; DMS-DR-2103) Avail: NTIS HC $10.75 CSCL 22B

Experimental aerodynamic investigations were conducted on a .004 scale model (34-OTS) orbiter, external tank, and solid rocket booster combined as an integrated vehicle in the NASA/MSFC 14 x 14 inch trisonic wind tunnel. The primary test objective was to determine the effect of a full length orbiter/external tank fairing on axial force. Secondary objectives were to define the static stability characteristics of the mated vehicle configuration with fairings over a Mach number range of 0.6 thru 4.96. Six component aerodynamic force and moment data were recorded over an angle of attack range from -10 deg to 10 deg at 0 deg sideslip angle and from -10 deg to 10 deg sideslip range at 0 deg and 5 deg angle of attack. Plotted and tabular results are presented herein. Author

N74-21523*# Chrysler Corp., New Orleans, La. Space Div.
EFFECT OF THE SIX ENGINE AIR BREATHING PROPULSION SYSTEM ON SPACE SHUTTLE ORBITER SUBSONIC AND TRANSONIC STABILITY AND CONTROL CHARACTERISTICS (OA91)
H. C. Smith (Rockwell Intern., Los Angeles) Mar. 1974 201 p refs
(Contract NAS9-13247)
(NASA-CR-134088; DMS-DR-2116) Avail: NTIS HC $13.25 CSCL 22B

Experimental aerodynamic investigations were conducted on a 0.015 scale representation (Model 42-0) of the VL70-000139B space shuttle orbiter configuration. The test objective was to determine the effect of three air breathing propulsion system ferry/flight test configurations on the transonic drag rise, the elevon effectiveness, the longitudinal stability, and the lateral-directional stability of the -139B shuttle orbiter. The model was sting mounted on a Task 1.5 inch internal strain gage balance, and six-component aerodynamic force and moment data were recorded over an angle of attack range of minus 3 deg to 14 deg at Mach numbers of 0.5, 0.6, 0.7, 0.8, and 0.9 with a Reynolds number of 6.4 million/ft. Data were also recorded at a sides lip angle of five degrees. Author

N74-21524*# TRW Systems Group, Redondo Beach, Calif.
SPACECRAFT SYSTEMS ANALYSIS PROJECT Bimonthly Progress Report, Jul. - Aug. 1973
15 Sep. 1973 81 p refs
(Contract NAS9-12330)
(NASA-CR-134239; TRW-20029-H209-R0-00) Avail: NTIS HC $7.25 CSCL 22B

The research in spacecraft analysis is reported. The Skylab task is reviewed along with the ASTP, and the shuttle tasks. The current status, progress, problems, and the work to be performed are described. F.O.S.

N74-21525# Royal Aircraft Establishment, Farnborough (England).
THE DETERMINATION AND USE OF THE ORBIT OF COSMOS 347 ROCKET (1970-43B)
H. Hiller Oct. 1973 19 p refs
(RAE-TR-73118; BR37406) Avail: NTIS HC $4.00

The orbit of Cosmos 347 rocket was determined, in the form of 23 sets of orbital elements at intervals during its 8-month life, with the aid of the orbit improvement program PROP, using about 850 observations from 47 observing stations. The values of orbital inclination obtained, which had standard deviations between 0.7 and 10 seconds of arc, were corrected by removing significant perturbations before being used to estimate the mean rotational speed of the earth's atmosphere to be 1.40 + or - 0.05 rev/day, at a mean height of 240 km. This value is higher than those obtained from other satellites. Values of density scale height were obtained, over the height range 208 to 245 km. Author (ESRO)

N74-21526# Acurex Corp., Mountain View, Calif. Aerotherm Div.
NOSETIP COOLING TECHNOLOGY (NCT) PROGRAM: INVESTIGATION OF DISCRETE INJECTION COOLING Final Technical Report
N. A. Jaffe, K. J. Clark, C. T. Nardo, and L. W. Anderson Oct. 1973 321 p refs
(Contract F04701-71-C-0087)
(AD-774590; Aerotherm-FR-73-84; SAMSO-TR-73-380) Avail: NTIS CSCL 13/1

The objective of the Nosetip Cooling Program (NCT) has been to develop engineering methods for designing discrete injection hardware based on a fundamental understanding of the complex mechanisms associated with heat and mass transfer over and within slotted surfaces. As a result, a series of experimental programs have been performed to identify the critical aerothermodynamic parameters associated with discrete injection transpiration cooling systems. The major finding of the NCT Program has been the identification and quantification of the effective surface roughness due to slotted surfaces. This roughness gives rise to augmented heating levels, both locally and downstream, for injection flow rates of interest. (Modified author abstract) GRA

N74-21527# Air Force Rocket Propulsion Lab., Edwards AFB, Calif.
DEVELOPMENT OF A SYSTEM FOR EXPOSING A THERMALLY STRESSED LIQUID ROCKET NOZZLE TO NUCLEAR RADIATION Final Report, May 1971 - May 1973
Jack E. Hewes Nov. 1973 30 p refs
(AF Proj. 5730)
(AD-774618; AFRPL-TR-73-104) Avail: NTIS CSCL 21/8

The report describes a system that was developed for use in a test in which the thermally stressed nozzle of a liquid

rocket engine would be exposed to nuclear radiation. To accomplish this objective the system developed had to be capable of firing the engine at a simulated 100,000 foot altitude and exposing the chamber throat immediately after firing to a nuclear beam. GRA

N74-21528# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN ANALYSIS OF STEADY ASYMMETRIC VORTEX SHEDDING FROM A MISSILE AT HIGH ANGLES OF ATTACK M.S. Thesis
John S. Kubin Nov. 1973 65 p refs
(AD-774390; GAM/AE/73A-13) Avail: NTIS CSCL 16/4

Recent developments of highly maneuverable missiles capable of operating at high angles of attack have shown that large unexpected side forces and yawing moments occur due to asymmetric vortex separation from a slender missile body. The objective of the report was to develop a mathematical model which accounted for the viscous effects of the boundary layer fluid that sheds as discrete vortices, and to predict the forces and moments on a missile. An aerodynamic model in the crossflow plane based on von Karman's vortex street theory was developed. The number of vortex filaments which were shed and the positions of the filaments where determined from experimental data as a function of the crossflow Mach number. The Strouhal number was used to relate time in the crossflow plane with time to travel along the missile. (Modified author abstract) GRA

N74-21529# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
PREDICTING LINE-OF-SIGHT CONJUNCTION BETWEEN A SPECIFIC SATELLITE AND OTHERS M.S. Thesis
Lee A. Mietz Dec. 1973 82 p refs
(AD-774388; GA/MC/73A-6) Avail: NTIS CSCL 22/3

The feasibility of designing a computer model to determine conjunction times between a primary object and any other satellite is investigated. An analytical integration scheme, which includes first order perturbations due to atmospheric drag and earth oblateness, is developed to predict satellite position in an inertial frame. Using an ellipsoidal, rotating earth model, conjunction between the primary object and any other satellite is determined by analyzing the respective topocentric vectors. Computer time is reduced by introducing discard schemes which retain only satellites that are a possible conjunction risk. Comparison between the computer model and existing methods of determination indicates the model is not only efficient, but computation time is significantly reduced. Author (GRA)

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N74-21530 University of Southern Calif., Los Angeles.
BIFURCATION BUCKLING AND FREE VIBRATION OF CONICAL SANDWICH SHELLS Ph.D. Thesis
Robert LeRoy Mann 1973 281 p
Avail: Univ. Microfilms Order No. 74-1670

The nonlinear strain-displacement relationships of SANDERS are extended to a three-layered sandwich shell where the displacement of the central layer or core is modified to include shear rotation as a new degree of freedom. Anisotropic properties are retained and unequal face thicknesses are permitted. Through the principle of virtual work, a matrix displacement solution is formulated for the geometrically nonlinear equilibrium equations of axisymmetric sandwich shells. The resulting equations are solved using a Newton-Raphson iteration. By superimposing small displacement perturbations, the bifurcation and free vibration eigenvalue problems are formulated. Eigenvalues are determined by trial and error and the associated eigenvalues are determined by the power method. Dissert. Abstr.

N74-21531 Michigan Univ., Ann Arbor.
THE FORMULATION AND SOLUTION OF PROBLEMS IN STRUCTURAL DESIGN FOR OPTIMUM PERFORMANCE Ph.D. Thesis
Prabhakaran Raman Kurudiyara 1973 86 p
Avail: Univ. Microfilms Order No. 74-3666

Problems in the prediction of the optimal design of elastic structures are taken up. Analytical formulation and methods for numerical treatment are discussed. Consideration is given to problems in the design of columns, single cables and axisymmetric shells. An iterative technique for the numerical treatment of such problems is applied to column design. This problem is expressed in the form: Predict the design which maximizes the Euler load among all columns of given volume of structural material. The algorithm for solution by iteration is laid out in detail. Extensive prior results on the problem provide a basis for evaluation of the numerical procedure. Examples are worked out for various classical boundary conditions. Cable design problems are considered in two forms: design for maximum elastic capacity (maximum strength), and design for maximum stiffness. Dissert. Abstr.

N74-21532 Case Western Reserve Univ., Cleveland, Ohio.
BUCKLING OF ECCENTRICALLY STIFFENED OVAL CYLINDER UNDER COMBINED BENDING AND COMPRESSION Ph.D. Thesis
Francis John Shaker 1973 123 p
Avail: Univ. Microfilms Order No. 74-2562

The buckling of an eccentrically stiffened oval cylinder under the action of combined bending and compression is investigated. The buckling equations are developed using the principle of minimum potential energy. Buckling solutions are obtained for the cylinder with classical simple support boundary conditions. Computed results are given for stiffened and unstiffened cylinders under pure compression, pure bending, and combined bending and compression. The numerical results indicate the existence of an optimum oval cross section for cylinders under pure bending and combined bending and compression. Dissert. Abstr.

N74-21533 Louisiana State Univ., Baton Rouge.
CREEP RELAXATION OF NONAXISYMMETRIC THERMAL STRESSES IN THICK WALLED CYLINDRICAL PRESSURE VESSELS Ph.D. Thesis
Mohamad Reza Eslami 1973 134 p
Avail: Univ. Microfilms Order No. 74-7219

Steady state temperature distribution of a thick-walled cylindrical pressure vessel subjected to nonaxisymmetric thermal boundary conditions was obtained. The corresponding thermal stresses in the cylinder subjected to the above temperature distributions were determined. Then, the creep relaxation of the thermal stresses based on a power creep law was obtained. In calculating the creep stress relaxation a general simple numerical method is presented. Based on this method, a computer program was written which calculates the creep relaxation at the thermal stresses of a thick-walled cylinder subjected to nonaxisymmetric temperature distribution. Dissert. Abstr.

N74-21534 Lehigh Univ., Bethlehem, Pa.
FATIGUE AND FRACTURE OF CRACKED PLATES UNDER COMBINED LOADING Ph.D. Thesis
Subbiah Pothiraj 1973 149 p
Avail: Univ. Microfilms Order No. 74-6695

The fatigue crack propagation and fracture behavior of centrally notched flat plates under combined loads are examined for 7075-T6 and 7075-T651 aluminum alloys. The cracked plates are subjected to both uniaxial and biaxial stresses to determine fatigue crack growth rates and critical values of the elastic stress intensity factor at fracture. A photoelastic coating technique was used to study the stress distribution and elastic-plastic boundary under uniaxial as well as biaxial static loading conditions in 2024-O aluminum plate with a center crack. Experiments were also conducted to study the fatigue behavior of cracked plates under combined bending and extensional loads. The investigation of crack growth behavior under fluctuating tensile stress along with superimposed constant bending stress indicate that the crack growth rate does not depend on superposed constant bending stress. Dissert. Abstr.

N74-21535 Northwestern Univ., Evanston, Ill.
CYCLIC CREEP BEHAVIOR OF ALUMINUM Ph.D. Thesis
Dinesh Kumar Shetty 1973 178 p
Avail: Univ. Microfilms Order No. 74-7820

An investigation to study the cyclic creep behavior of high purity (99.999%) aluminum in the temperature range 77 K - 295 K is described. Two kinds of cyclic creep behavior are observed. In the first kind, labeled as cyclic stress acceleration enhancement of creep rate is observed when the creep stress is cycled. The second kind referred to as cyclic stress retardation indicates suppression of creep deformation. Higher stresses and cyclic stress amplitudes promote cyclic stress acceleration. Cyclic stress retardation was observed at lower stresses and it was pronounced at 77 K. A threshold stress was defined corresponding to the transition in the cyclic creep behavior. Above 295 K, the cyclic creep behavior follows the predictions of the static creep more closely. Dissert. Abstr.

N74-21536 Illinois Univ., Urbana.
RELATIONSHIP BETWEEN TENSILE PROPERTIES AND MICROSCOPICALLY DUCTILE PLANE STRAIN FRACTURE TOUGHNESS Ph.D. Thesis
Richard Howard Sailors 1973 143 p
Avail: Univ. Microfilms Order No. 74-5684

An expression that will permit plane strain fracture toughness, to be calculated from a knowledge of uniaxial tensile properties is developed. Extensive analytical analyses of near crack tip behavior had been performed for plane stress rigid plastic material behavior but not for plane strain work hardening material behavior. Thus, the results of the plane stress rigid plastic behavior were corrected for constraint and strain hardening and found to accurately describe experimental crack opening displacement on steels having yield strengths from 36 to 161 ksi. The crack opening displacement imposed strain distribution at fracture was investigated by measuring fracture ductility for the biaxial stress state, which exists at the blunted crack tip, and the triaxial stress state, which exists ahead of the crack tip. Dissert. Abstr.

N74-21537 North Carolina State Univ., Raleigh.
AN EXPERIMENTAL INVESTIGATION OF LARGE AMPLITUDE WAVE PROPAGATION AND DYNAMIC ELASTIC PROPERTIES IN LONGITUDINALLY-IMPACTED POLYCARBONATE RODS Ph.D. Thesis
Will Lithgow Liddell 1973 151 p
Avail: Univ. Microfilms Order No. 74-5474

An experimental study which investigates the dynamic mechanical behavior of a polycarbonated material (Lexan) is described. Using an experimental system, polycarbonate rods are subjected to high velocity axial impact. During propagation of the resulting large-amplitude strain waves, high-speed streak cameras record axial surface strain-dependent and surface rotation-dependent diffraction patterns from in-surface diffraction grating strain transducers illuminated by a pulsed ruby laser. To interpret this recorded data, diffraction-strain relationships are developed and utilized to compute axial surface strain-time and surface rotation-time histories from data taken at locations from one-third to four diameters from the impact site. These histories, covering times to 250 micro sec after impact, show axial strains to 20 percent and strain rates to 15,700/sec produced by axial impact at striker velocities to 700 ft/sec. Dissert. Abstr.

N74-21538 Lehigh Univ., Bethlehem, Pa.
ELASTIC AND INELASTIC THIN PLATE THEORY AND ITS APPLICATIONS Ph.D. Thesis
Sampath N. S. Iyengar 1973 126 p
Avail: Univ. Microfilms Order No 74-6685

A method of analysis to investigate the behavior of a thin rectangular steel plate in the elastic and inelastic ranges is proposed. The plate, supported on all of its edges, may be subjected to transverse, in-plane or combined loadings and may have external elastic restraints. The governing differential equations of the elastic large deflection theory of thin plates are suitably modified to account for inelastic behavior when this occurs. The equations are then solved using finite differences and special iterative techniques. The plate theory and solution are further applied to study the behavior of the web in a rolled shape under pure compression, pure bending or combined compression and bending. Current limitations on web geometry are reviewed and suggestions for revision are made, based on test results and the application of the plate theory. Dissert. Abstr.

N74-21539 North Carolina State Univ., Raleigh.
PRESTRESSED CONCRETE MEMBERS UNDER TORSION, SHEAR, AND BENDING Ph.D. Thesis
William Denis McGee 1973 217 p
Avail: Univ. Microfilms Order No. 74-5495

Forty-five prestressed concrete beams, both eccentrically and concentrically prestressed, were tested under varying ratios of torsion, shear, and bending. Both members with and without web reinforcement were included. All members were 6 x 12 in. cross-section and varied in length from approximately 9 to 14 ft. None of the members contained longitudinal mild steel reinforcement. Equations were developed to predict the cracking and ultimate torsional strenghts of prestressed rectangular, flanged, and box sections. This work was extended to the development of a design procedure for such members loaded in combined torsion, shear, and bending. Dissert. Abstr.

N74-21540 University of Southern Calif., Los Angeles.
DYNAMIC ANALYSIS OF HYDROELASTIC SYSTEMS USING THE FINITE ELEMENT METHOD Ph.D. Thesis
Henry Chien Hsin Hsiung 1973 399 p
Avail: Univ. Microfilms Order NO. 74-5867

The finite element method is applied to the free vibration analysis of the three systems: (1) an axisymmetric, thin, elastic shell partially filled with an incompressible fluid; (2) an arbitrary shaped rigid cavity partially filled with an incompressible fluid to a shallow depth; (3) a closed, axisymmetric, thin elastic shell filled with a compressible fluid. In all three systems, the fluid is assumed to be homogeneous, isotropic, nonviscous, and the motion is irrotational. The governing equations were derived from the linearized Navier-Stokes equation and the Eulerian continuity equation. The fluid is discretized by triangular or quadrilateral ring elements in system one, system three, and by triangular or quadrilateral prism elements in system two. Dissert. Abstr.

N74-21541# National Aerospace Lab., Amsterdam (Netherlands).
ENVIRONMENT AND FREQUENCY EFFECTS DURING FATIGUE CRACK PROPAGATION IN Ti-2.5 Cu (IMI 230) SHEET AT ROOM TEMPERATURE
R. J. H. Wanhill Aug. 1972 29 p refs Submitted for publication
(NLR-MP-72024-U; ICAF-Doc-700) Avail: NTIS HC $4.50

Environmental fatigue crack propagation at various frequencies is considered for Ti-2.5Cu (IMI 230) sheet. The environments were dry argon, normal air, distilled water and 3.5% aqueous NaCl. The frequencies employed were 5, 29, 30 and 50 Hz. Crack propagation rate data are compared in terms of environment and frequency and also with rates predicted by a mechanical model. Results of these comparisons are discussed together with fractographic observations in order to provide a rationale for the effects of environment and frequency on mechanics of crack growth. Author

N74-21542# Defence Standards Labs., Maribyrnong (Australia).
STRAIN DISTRIBUTIONS AND DISLOCATION SUBSTRUCTURES BENEATH ABRADED SURFACES OF 70/30 BRASS
D. M. Turley and L. E. Samuels Jul. 1972 16 p refs
(DSL-469) Avail: NTIS HC $4.00

Two distinct layers can be observed by optical microscopy beneath abraded surfaces, an outer fragmented layer adjacent to the surface and beneath this is a deformed layer. Examination of these layers in transmission in the electron microscope has shown that in 70:30 brass the outer fragmented layer consists of subgrains and the deformed layer of deformation twins and dislocations. The dislocation substructures observed in these layers are in most respects similar to those previously observed beneath surfaces machined by a simple planning operation and in cold-rolled specimens. Comparison of the dislocation structures in the three cases enables the strains beneath abraded surfaces to be estimated. The natural strain in the fragmented layer is estimated to be slightly less than 6, the strain decreasing very rapidly at the boundary to the deformed layer. At deeper levels

in the deformed layer the strain decreases less rapidly with increasing depth until the elastic-plastic boundary between the deformed and underformed material is reached. Author

N74-21543*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PLANE-STRESS FRACTURE OF COMPACT AND NOTCH-BEND SPECIMENS
J. C. Newman, Jr. Feb. 1974 19 p refs Presented at the 10th Anniv. Meeting of the Soc. of Eng. Sci., Raleigh, N. C., 5-7 Nov. 1973
(NASA-TM-X-71926) Avail: NTIS HC $4.00 CSCL 20K

Thin-gaged or high toughness materials containing cracks usually fail in a ductile manner with nominal failure stresses approaching the ultimate strength of the material. For such materials, a two-parameter fracture criterion was developed. An equation which related the linear elastic stress-intensity factor, elastic nominal stress, and two material parameters was previously derived and has been used as a fracture criterion for surface- and through-cracked specimens under tensile loading. This two-parameter fracture criterion was rederived in a more general form and was extended to compact and notch-bend fracture specimens. A close correlation was found between experimental and predicted failure stresses. Author

N74-21544*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A UNIFIED TECHNOLOGY PLAN FOR FATIGUE AND FRACTURE DESIGN
Herbert F. Hardrath Jul. 1973 22 p refs Presented at 12th Symp. of Intern. Comm. on Aeron. Fatigue, London, Jul. 1973 Submitted for publication
(NASA-TM-X-71923) Avail: NTIS HC $4.25 CSCL 20K

An integrated research program is proposed that seeks to improve the technology of designing against fatigue and fracture and to develop a computerized capability for assessing the adequacy of a given design. Both fatigue life prediction and damage tolerance considerations are incorporated. The research for each of these considerations is organized to account for material behavior, the effect of structural configurations, the cumulative effects of the operating loadings, and for the effects of environment - temperature and corrosion. The goal is to achieve a viable fatigue and fracture design procedure for any practical problem. The overall program is outlined, assessments are made of the state of the art, subgoals are proposed, and means for achieving them are suggested. Author

N74-21545*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FRACTURE MECHANICS
Herbert F. Hardrath 31 Jan. 1974 12 p refs Presented at AIAA 12th Aerospace Sci. Meeting, Washington, D. C., 31 Jul. 1974
(NASA-TM-X-71925) Avail: NTIS HC $4.00 CSCL 20K

Fracture mechanics is a rapidly emerging discipline for assessing the residual strength of structures containing flaws due to fatigue, corrosion or accidental damage and for anticipating the rate of which such flaws will propagate if not repaired. The discipline is also applicable in the design of structures with improved resistance to such flaws. The present state of the design art is reviewed using this technology to choose materials, to configure safe and efficient structures, to specify inspection procedures, to predict lives of flawed structures and to develop reliability of current and future airframes. Author

N74-21546*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DEBOND PROPAGATION IN COMPOSITE REINFORCED METALS
G. L. Roderick (Army Air Mobility R and D Lab.), R. A. Everett, and J. H. Crews, Jr. Feb. 1974 18 p refs Presented at ASTM Symp. on Fatigue of Composite Mater., Bal Harbour, Fla., 2-7 Dec. 1973
(NASA-TM-X-71948) Avail: NTIS HC $4.00 CSCL 20K

Strain energy release rates were used to correlate cyclic debonding between metal sheets and composite reinforcement. An expression for the strain energy release rate was derived and applied to fatigue test results for three material systems: graphite bonded to aluminum with both a room temperature and an elevated temperature curing adhesive, and S-glass bonded to aluminum with an elevated temperature curing adhesive. For each material system, several thicknesses were tested with a range of fatigue loads. Cyclic debonding was monitored using a photoelastic technique. A close correlation was found between the observed debond rates and the calculated strain energy release rates for each material system. Author

N74-21547*# National Bureau of Standards, Washington, D.C. Mechanics Div.
TENSILE BEHAVIOR OF BORON/EPOXY REINFORCED 7075-T6 ALUMINUM ALLOY AT ELEVATED TEMPERATURES
Daniel J. Chwirut and George F. Svshinsky Mar. 1974 33 p refs
(NASA Order L-43554)
(NASA-CR-136895; NBS-TN-812) Avail: NTIS HC $4.75; SOD HC $0.65 as C13.46:812 CSCL 20K

Static tensile tests were performed on specimens of 7075-T6 aluminum alloy, 0 deg unidirectional boron/epoxy, and 7075-T6 aluminum alloy reinforced on the surface with 0 deg unidirectional boron/epoxy laminate, at four temperatures up to 300 F (149 C). Analytical load-strain curves are formulated for the reinforced-metal specimens using the rule of mixtures, assuming that the longitudinal strains in the composite and the metal remain equal, and taking account of the residual stresses caused by the fabrication process. Two analytical curves are plotted for each reinforced-metal specimen, one based on the measured ply thickness of the composite, and one based on a nominal 0.005-in (0.13-mm) ply thickness. In general, the experimental load-strain curves fall between the two analytical curves for each specimen. Author

N74-21548*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SHEAR-STRESS INTENSITY FACTORS FOR ELASTIC SHEETS WITH COVER PLATES
W. B. Fichter Washington Apr. 1974 27 p refs
(NASA-TN-D-7473; L-8882) Avail: NTIS HC $3.25 CSCL 20K

Shear stress intensity factors are calculated for three problems concerning inextensible cover plates either bonded to or embedded in an elastic sheet which is under uniaxial tension. The stress intensity factors are small when the ratio of sheet thickness to cover plate length is small and, as the ratio increase, rapidly approach their asymptotic values for infinite sheet thickness. In the problem of the embedded cover plate, the stress intensity factor also depends on the Poisson's ratio of the sheet material. The dependence on Poisson's ratio, however, is significant only when the ratio of sheet thickness to cover plate length is small. Some possible implications of the present results for debonding of reinforced sheets under cyclic loading are briefly discussed. Author

N74-21549# Advisory Group for Aerospace Research and Development, Paris (France).
SURVEY OF ACTIVITIES IN THE FIELD OF LOW CYCLE HIGH TEMPERATURE FATIGUE. CRITICAL REPORT
J. M. Drapier (Centre de Recherch. Met., Liege, Belgium) Feb. 1974 149 p refs Presented at the 37th Meeting of the AGARD Struct. and Mater. Panel, The Hague, 7-12 Oct. 1973
(AGARD-R-618) Avail: NTIS HC $10.50

Information on the activities in low cycle fatigue testing at high temperature (LCHTF) was gathered during the visit of 38 laboratories (industry and universities) from 7 NATO countries. It covers several facets of the LCHTF problem, namely: materials, testing equipments and conditions, types of data plots, latest developments in prediction laws for the fatigue behaviour of materials and design procedures for predicting lives in different engine components. Author

N74-21550# Lockheed Missiles and Space Co., Palo Alto, Calif.
STATISTICAL CRITERION OF THE DANGER OF MATERIAL FRACTURE IN A COMPLEX STRESS STATE
D. M. Shur [1973] 7 p refs Transl. into ENGLISH from Mashinovedenie (USSR), no. 1, 1971 p 51-58

Avail: NTIS HC $4.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A simple statistical model of a solid is proposed, which permits giving an estimate of the danger criterion for material fracture as a function of the kind of stress state. The assumptions that the mechanical strength is a random variable, and the rupture is independent of tangential stress are considered in a polycrystalline solid. The mean probability formulas for biaxial and uniaxial tension are derived. It is shown that qualitative deductions and general statistical theories of strength can be obtained, and the dependence of strength properties on the body size and stress state can be predicted. F.O.S.

N74-21551*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

APPLICATION OF BOUNDARY INTEGRAL METHOD TO ELASTOPLASTIC ANALYSIS OF V-NOTCHED BEAMS

Walter Rzasnicki, Alexander Mendelson, Lynn U. Albers, and Demetrius D. Raftopoulos (Toledo Univ.) Washington Apr. 1974 43 p refs

(NASA-TN-D-7637; E-7658) Avail: NTIS HC $3.25 CSCL 20K

The boundary integral equation method was applied in the solution of the plane elastoplastic problem. The use of this method was illustrated by obtaining stress and strain distributions for a number of specimens with a single-edge notch and subjected to pure bending. The boundary integral equation method reduced the inhomogeneous biharmonic equation to two coupled Fredholm-type integral equations. These integral equations were replaced by a system of simultaneous algebraic equations and solved numerically in conjunction with a method of successive elastic solutions. Author

N74-21552*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

ANALYSIS OF LAMINATED, COMPOSITE, CIRCULAR CYLINDRICAL SHELLS WITH GENERAL BOUNDARY CONDITIONS

S. Srinivas Washington Apr. 1974 78 p refs

(NASA-TR-R-412; L-8828) Avail: NTIS HC $4.00 CSCL 20K

This report develops: (1) a refined approximate theory for the static and dynamic analyses of finite, laminated, composite, circular cylindrical shells with general boundary conditions; (2) an exact three-dimensional analysis of simply supported, laminated, composite, circular cylindrical shells, and (3) a thin-shell theory for laminated, composite, circular cylindrical shells. In the refined approximate theory the displacements are assumed piecewise linear across the thickness and the effects of transverse shear deformations and transverse normal stress are included. A variational approach is followed to obtain the governing differential equations and boundary conditions. A general solution of the governing differential equations is also presented. The results obtained by using the refined approximate theory and the thin-shell theory are compared with the exact results for the case of free vibrations of simply supported, laminated, composite, circular cylindrical shells. The refined approximate theory is very accurate, even for thick shells with short nodal distances, whereas thin-shell theory is reasonably accurate only for thin shells at moderate nodal distances and wave number less than 2. Author

N74-21553# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft-und Raumfahrtkonstruktionen.

EXPERIMENTAL OSCILLATION AND DAMPING INVESTIGATIONS OF CABLES AND CABLE NETS [EXPERIMENTELLE SCHWINGUNGS- UND DAEMPFUNGSUNTERSUCHUNGEN AN SEILEN UND SEILNETZEN]

John H. Argyris, Werner Aicher, and Hans Flueh Jun. 1973 36 p refs In GERMAN

(ISD-141) Avail: NTIS HC $5.00

Damping values of oscillating ropes were determined experimentally. In view of the high precision required, a data measurement system was developed. The measurements were, to a large extent, carried out automatically using the central control system and the real time software available. Results are presented and discussed. ESRO

N74-21554# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.

OSCILLATION STABILITY OF INTERNALLY AND EXTERNALLY NOTCHED PLANE BARS OF EQUAL FORM FACTOR FROM 3.4364.7 (7075-T6) Final Report [SCHWINGFESTIGKEIT INNEN- UND AUSSENGEKERBTER FLACHSTAEBE GLEICHER FORMZAHL AUS 3.4364.7 (7075-T6)]

John H. Argyris, Werner Aicher, and Gerhard Kierner 1973 30 p refs In GERMAN

(Contract DFG-AR-44/10)

(ISD-145) Avail: NTIS HC $4.50

The stress strength of internally and externally notched plane bars with equal form factors was investigated. The notch factors were calculated by means of the finite element method. For the stress ratio R equals O and different form factors, the crack load cycles were determined, for internally notched bars, using microfractographic evaluation of single step experiments. ESRO

N74-21555# Stuttgart Univ. (West Germany). Inst. Fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.

A GENERAL METHOD FOR THE SHAPE FINDING OF LIGHTWEIGHT TENSION STRUCTURES

J. H. Argyris, T. Angelopoulos, and B. Bichat 1973 29 p refs Prepared jointly with Imperial Coll. of Sci. and Technol.

(ISD-146) Avail: NTIS HC $4.50

A computer based procedure for finding the shape of tension roof structures is presented. The procedure is based on the iterative method used to obtain equilibrium of prestressed nets and is quicker, more accurate, and cheaper than that using models. A number of examples taken from existing and proposed large scale structures are given. ESRO

N74-21556# Institut fuer Festkoerpermechanik, Freiburg (West Germany).

THEORETICAL AND EXPERIMENTAL INVESTIGATIONS ON THE PROPAGATION DIRECTION OF BIFURCATED CRACKS [THEORETISCHE UND EXPERIMENTELLE UNTERSUCHUNGEN ZUR AUSBREITUNGSRICHTUNG GEGABELTER RISSE]

Joerg F. Kalthoff Jul. 1972 132 p refs In GERMAN; ENGLISH summary

(WB-7/72) Avail: NTIS HC $9.75

The propagation direction of branched cracks in plates subjected to uniaxial uniform tension was investigated. A static stress analysis was conducted for a model of a bifurcated crack. Using the method of finite differences, the stress-intensity factors were calculated for forked cracks with varying branching angles. The results show a mutual interaction of the stress distributions at the tips of the branches which leads to a direction criterion: for small angles a repulsion of the branches occurs while for larger angles there is an attraction. Propagation in the original crack direction is expected only for a characteristic angle alpha (o). These predictions were verified by experimental investigations. Author (ESRO)

N74-21557# Institut fuer Festkoerpermechanik, Freiburg (West Germany).

AN ELEMENTARY MODEL FOR YIELDING AND SLIP IN ADHESIVE JOINTS

Russell A. Westmann (Calif. Univ., Los Angeles) Jan. 1973 41 p refs

(WB-1/73) Avail: NTIS HC $5.25

The analytical results of a stress and displacement analysis for an elementary model of an adhesive joint are presented. The joint is modeled by two elastic half-planes connected by an infinitely thin bond line of finite length. It was assumed that the connection transfers a resultant normal and shear force as well as a resultant moment. Inelasticity in the adhesive was accounted for by permitting yielding and slip to take place along the bond line. The pertinent stress and displacement components along the bond line were obtained by using the approach of Barenblatt-Dugdale and singular integral equations. The failure of the joint was predicted analytically upon employing the concept of a critical COD or a critical plastic zone size. These results are compared with the predictions made by the brittle fracture theory. Author (ESRO)

N74-21558# Institut fuer Festkoerpermechanik, Freiburg (West Germany).

A STRUCTURAL MODEL IN ADHESIVE MECHANICS

Russell A. Westmann May 1973 25 p refs
(WB-6/73) Avail: NTIS HC $4.25

Preliminary structural model suitable for the approximate stress analysis of adhesive joints is presented. This approximate model is based upon a refined plate theory which accounts for both shearing and plate thickness deformations. To assess the accuracy of the model, the problem of a double cantilever beam test specimen was considered, and expressions for the bond line tractions and crack tip stress intensity factors are presented. These approximate results are compared with values obtained by other methods, and the agreement is good for a range of the geometric parameters. Author (ESRO)

N74-21559# Institut fuer Festkoerpermechanik, Freiburg (West Germany).
EXPERIMENTAL STUDY OF SHOCK INDUCED WAVE PROPAGATION IN FINITE PLATES [EXPERIMENTELLE UNTERSUCHUNGEN ZUR STOSSANGEREGTEN WELLENAUSBREITUNG IN STREIFENFOERMIGEN PLATTEN]
Uwe Soltesz May 1973 100 p refs In GERMAN; ENGLISH summary
(WB-7/73) Avail: NTIS HC $8.00

The spatial and temporal variation of the dynamic stresses produced by an air shock applied to the shortest side of a finite plate was examined optically. Araldit B was chosen as the model material because of its high photoelastic sensitivity and its linearly elastic behavior within the loading domain. The required directions of the three principal stresses were determined by means of a shadow-optic technique. The mean values of the stresses through the plate thickness were then ascertained from measurements of the variations of the optical paths employing a Mach-Zehnder interferometer using two different polarization orientations and changes in specimen thickness employing a Michelson interferometer. The stress distributions exhibit damped oscillations consisting of several modes associated with the plate width and thickness. The behavior of stationary cracks under these circumstances is discussed. Author (ESRO)

N74-21560# Forest Products Lab., Madison, Wis.
MECHANICAL PROPERTIES OF DIFFUSION-BONDED TITANIUM SANDWICH CONSTRUCTIONS
Edward W. Kuenzi 1973 21 p refs
(AD-773428; FSRP-FPL-218) Avail: NTIS CSCL 01/3

The performance of diffusion-bonded titanium sandwich constructions was determined by evaluating flatwise shear, flatwise tensile, and compressive properties at room temperature. Shear and flatwise tension fatigue data were also obtained at room temperature. Edgewise compression tests were conducted on sandwich with three different facing thicknesses at temperatures up to 1200F. Fatigue loading of edgewise compression specimens was done at room temperature. Shear fatigue strength approached about 10 percent of static shear strength and flatwise tensile fatigue strength about 5 percent of static strength. Edgewise compression fatigue endurance limit was from 60 to 70 percent of static strength values. Effects of increasing temperature dropped static edgewise compressive strength, especially at 1200F.
Author (GRA)

N74-21561# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AXISYMMETRIC BENDING OF ROUND PLATES AND MILDLY SLOPING SPHERICAL DOMES CONSIDERING PHYSICAL AND GEOMETRIC NONLINEARITIES
M. S. Ganeeva 30 Jan. 1974 9 p refs Transl. into ENGLISH from Issled. Teor. Plastin Obolochek (Kazan), no. 9, 1972 p 265-270
(AD-773871; FTD-HT-23-349-74) Avail: NTIS CSCL 20/1

The report derives a formulation for the bending of physical nonlinear domes subjected to external loads. GRA

N74-21562# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE THEORY OF BENDING AND STABILITY IN ORTHOTROPIC PLATES AND SHELLS
A. V. Sachenkov and M. Z. Sabitov 9 Jan. 1974 12 p refs Transl. into ENGLISH from Issled. Teor. Plastin Obolochek (Kazan), no. 9, 1972 p 332-338
(AD-773512; FTD-HT-23-352-74) Avail: NTIS CSCL 20/11

A new approach is proposed to solving nonlinear problems of stability and bending in anisotropic plates and shells. The method is based on the use of a precise solution to the equation of strain compatibility. The basic nonlinear equation of bending, containing only one unknown function of deflection, is derived. A qualitative study of the solution to this equation is made.
GRA

N74-21563# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DIFFERENCE-ENERGY METHOD OF STUDYING THE STABILITY OF RECTANGULAR PLATES DURING SHEAR
A. V. Buledza 28 Dec. 1973 11 p refs Transl. into ENGLISH from Issled. Teor. Plastin Obolochek (Kazan), no. 9, 1972 p 189-196
(AD-773511; FTD-HT-23-344-74) Avail: NTIS CSCL 20/11

The paper examines a rectangular isotropic plate under the effect of a shearing load uniformly distributed along the contour. GRA

N74-21564# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE SMALL-PARAMETER METHOD IN A TWO-DIMENSIONAL PROBLEM OF THE THEORY OF ELASTICITY OF AN ANISOTROPIC BODY
A. V. Sachenkov and V. I. Daragan 9 Jan. 1974 30 p refs Transl. into ENGLISH from Issled. Teor. Plastin Obolochek (Kazan), no. 8, 1972 p 77-95
(AD-773513; FTD-HT-23-356-74) Avail: NTIS CSCL 20/11

The paper presents two methods of representing equations in a two-dimensional problem of elasticity theory and a solution, of the latter by the small-parameter method. With the use of an affine transformation of coordinates, the approximate solution to a two-dimensional problem for an anisotropic body reduces to the solution of two-dimensional problems for isotropic bodies, with which each approximation requires the solution of only one isotropic problem. GRA

N74-21565# California Univ., Irvine.
VIBRATIONAL EDGE MODES FOR SMALL ANGLE WEDGES Final Report
T. M. Sharon, A. A. Maradudin, and S. L. Cunningham 18 Jan. 1974 13 p refs
(Contract N00014-69-A-0200-9003; Grant AF-AFOSR-2018-72)
(AD-773474; TR-73-44) Avail: NTIS CSCL 20/12

Moss, Maradudin, and Cunningham recently calculated the velocities of long wavelength acoustic phonons localized at the apex of a variable-angle semi-infinite elastic wedge. The authors present here a method by which more precise results may be obtained for small wedge angles. Author (GRA)

N74-21566# Washington Univ., Seattle. Dept. of Mechanical Engineering.
SOME TWO-DIMENSIONAL PROBLEMS IN FRACTURE MECHANICS
A. S. Kobayashi Jan. 1974 42 p refs
(Contract N00014-67-A-0130-0018; NR Proj. 064-478)
(AD-774127; TR-18) Avail: NTIS CSCL 20/11

The author's initiation to fracture mechanics through Dr. G. R. Irwin and his guidance in subsequent developments are illustrated through two-dimensional problems in fracture mechanics. These problems include the M sub k factor for deep surface flaw, Dugdale yield strip for a slanted crack in a tension plate, crack in a stringer reinforced tension plate, crack branching, and crack curving. Author (GRA)

N74-21567# Naval Research Lab., Washington, D.C.
SOME FRACTURE MECHANICS RELATIONSHIPS FOR THIN SHEET MATERIALS Final Report
A. M. Sullivan and J. Stoop 21 Dec. 1973 26 p refs
(AD-774487; NRL-7650) Avail: NTIS CSCL 11/6

The fracture resistance parameter Kc has been determined for a number of aluminum, titanium, and steel alloy sheet materials over a thickness range of 0.032 to 0.25 in. (0.8 to 6.25 mm). The Kc parameter is found to depend inversely upon the material yield stress. Further, a relationship can be established between Kc and fracture appearance. Analysis of the data has also

disclosed that the amount of crack extension, i.e., final crack length appears to be influenced by the initial crack length. A straight-line curve in logarithmic coordinates relates the ratio of initial to final crack length. The development of these relationships can be of real assistance in the design of a standard initial screening test for Kc. (Modified author abstract) GRA

N74-21568# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
DETERMINATION OF THE EFFECTS OF MASS AND STIFFNESS ON THE VIBRATION RESPONSE OF RIBBED PANELS SUBJECTED TO RANDOM ACOUSTIC NOISE M.S. Thesis
Clarence M. Bose Dec. 1973 111 p refs
(AD-774436; GA/MC/73A-1) Avail: NTIS CSCL 01/3

The purpose of the report is to experimentally determine the effects of localized mass and stiffness parameters on the vibration response of stiffened panel structures excited by acoustic noise. Eleven panels were constructed, similar in weight and configuration with typical aircraft panel structures. A baseline panel was used to determine reference mass and stiffness properties; five panels were varied in mass with stiffness kept constant, and five panels with constant mass were in stiffness. The panels were excited in an acoustic reverberation test facility using a broad-band siren and horn assembly. Excitation and response measurements were taken using microphone and accelerometer transducers attached to the panels. The data were then reduced and correlated to construct vibration prediction curves as a function of excitation/response levels, frequency, and mass and stiffness parameters. (Modified author abstract) GRA

N74-21569# System Development Corp., Santa Monica, Calif.
CUMULATIVE FATIGUE DAMAGE THEORY AND MODELS Final Report, 1 Jul. 1971 - 30 Jun. 1973
V. K. Murthy and G. Boyd Swartz (Monmouth Coll., N. J.) Wright-Patterson AFB, Ohio ARL Dec. 1973 78 p
(Contract F33615-71-C-1776; AF Proj. 7071)
(AD-774529; ARL-73-0170) Avail: NTIS CSCL 11/6

The report consists of six sections of original contributions to the theory of cumulative fatigue damage of airframe structures and an appendix, which consists of annotated bibliography of some additional important papers in cumulative fatigue damage. GRA

N74-21570# Aeronautical Research Associates of Princeton, Inc., N.J.
A SIMPLE INTEGRAL THEORY FOR IMPACT CRATERING BY HIGH SPEED PARTICLES Final Report
Coleman duP. Donaldson and Thomas B. McDonough 4 Dec. 1973 56 p refs
(Contract DNA001-72-C-0199)
(AD-774509; ARPA-201; DNA-3234F) Avail: NTIS CSCL 19/4

A theory for impact cratering by high velocity particles is developed and compared with experimental observations. The purpose of this work is to provide an explanation of the observed trends in terms of the physical characteristics of the impact, including properties of both the target and projectile. The goal of the theory is to provide a simple rational approach with which observed experimental trends can be understood, critical tests planned, design performance predicted, and erosion-resistant materials formulated. (Modified author abstract) GRA

N74-21571# Naval Air Engineering Center, Philadelphia, Pa. Ground Support Equipment Dept.
LOX (LIQUID OXYGEN) TANK FATIGUE DETECTION Final Report
Thomas Dale Weikel Dec. 1973 17 p refs
(AD-774474; NAEC-GSED-76) Avail: NTIS CSCL 13/4

Reinforced 400-gallon tanks of liquid oxygen (LOX) are airlifted to aircraft carriers during emergency resupply operations. These tanks must withstand large mechanical shock loadings during cable-arrested landings. A magnetometer system has been developed to monitor straining and metallurgical changes which result in the 304-series stainless steel inner tank wall. This change from austenite to martensite can be related to remaining fatigue life, and the tank removed from service before failure occurs. Author (GRA)

N74-21572# Israel Inst. of Tech., Haifa. Dept. of Materials Engineering.
DYNAMIC INELASTIC BEHAVIOR OF MATERIALS, PART 3 Final Scientific Report, 1 Dec. 1971 - 30 Nov. 1973
Sol R. Bodner Dec. 1973 15 p refs
(Contract F44620-72-C-0004; AF Proj. 9782)
(AD-774530; MED-42-Pt-3; AFOSR-74-0152TR) Avail: NTIS CSCL 11/6

The principal subjects investigated were the development of constitutive equations to realistically represent the viscoplastic and anelastic characteristics of materials for arbitrary loading histories, the mechanics of ballistic perforation of metallic plates, and the role of damping and acoustic emission during discontinuous yielding of metals. The accomplishments of the program are discussed and the proposed directions of future research are indicated. (Modified author abstract) GRA

N74-21573# California Univ., San Diego. Dept. of Applied Mechanics and Engineering Sciences.
A GENERAL CONTINUUM THEORY FOR VISCOELASTIC LAMINATED COMPOSITES
T. C. Bache and G. A. Hegemier Nov. 1973 12 p refs
(Grant AF-AFOSR-1957-70; AF Proj. 9782)
(AD-774112; AFOSR-74-0135TR) Avail: NTIS CSCL 20/11

In the report linear viscoelastic material behavior is introduced into a continuum theory with microstructure for wave propagation in laminated composite materials which was earlier developed for elastic laminated composites. A constitutive law of convolution form is postulated allowing the application of the correspondence principle of linear viscoelasticity. The equations of general two-dimensional theory are given. From these the governing equations for the limiting cases of propagation normal and parallel to the layering are immediately available. For the limiting cases, an approximate theory particularly well-suited for computation is discussed. Author (GRA)

N74-21574# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
THEORY OF BUCKLING AND POST-BUCKLING BEHAVIOR OF ELASTIC STRUCTURES
Bernard Budiansky Oct. 1973 96 p refs Submitted for publication
(Grant AF-AFOSR-2476-73; AF Proj. 9782)
(AD-774102; DEAP-S-5; AFOSR-74-0141TR) Avail: NTIS CSCL 20/11

The general theory of buckling and post-buckling of elastic structures is presented in a form that exploits the notation of functional analysis. Both the energy approach and the virtual work approach are given in detail, together with applications to example problems. A final section discusses post-buckling mode interaction. Author (GRA)

N74-21575# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A SPHERICAL RESERVOIR ON POINT SUPPORT
N. G. Guryanov 7 Jan. 1974 16 p refs Transl. into ENGLISH from Issled. po Teorii Plastin in Obolochek (USSR), v. 9, 1972 p 205-211
(AD-774382; FTD-HT-23-681-74) Avail: NTIS CSCL 20/11

A numerical analysis was conducted to determine the strain of a full sphere situated on a specified number of points and filled with a fluid having a designated specific weight. Mathematical models are presented to define the stress conditions. Emphasis is placed on solving the bending moments of the shell. Author

N74-21576# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.
BUCKLING AND POSTBUCKLING STUDIES OF TORSION-LOADED THIN-WALL CYLINDRICAL SHELLS WITH CUTOUTS Interim Report
John S. Strenkowski and Emmett A. Witmer Oct. 1973 109 p refs
(Contract DAAG46-72-C-0212; DA Proj. 1T0-61102-B-33A)
(AD-774287; ASRL-TR-171-1; AMMRC-CTR-73-39) Avail: NTIS CSCL 20/1

An experimental study of the pre-buckling and postbuckling behavior of thin aluminum cylindrical shells with R/h of 100 under a pure applied torque is reported. The investigation includes initially-undamaged and pre-damaged cylindrical shells. The types of predamage include a single circular 1-inch diameter hole, and a single size rectangular slot (3/8-inch wide and 2.10-inch long) with orientations of 0, 45, and 90 degrees to the longitudinal axis of the cylindrical shell. Postbuckling behavior of these specimens is investigated for large twist angles, for both monotonically-increasing angular deflections and for unloading-reloading behavior. Load-deflection characteristics and buckling patterns distinctive to each type of specimen tested are presented. Finally, comments are offered on idealizing these buckling patterns for possible use in the future development of approximate methods for predicting these types of postbuckling load-deflection behavior. Author (GRA)

N74-21577# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
EXPERIMENTAL INVESTIGATION OF THE DYNAMIC CHARACTERISTICS OF NON-ISOLATED EQUIPMENT MOUNTS M.S. Thesis
Lucien Stephen Franscini, III Nov. 1973 87 p refs
(AD-774433; GAM/MC/73A-2) Avail: NTIS CSCL 09/3

The study was conducted to determine the dynamic characteristics of non-isolated avionics equipment mounts and the effect of the characteristics on the equipment the mount supports. The response to both sinusoidal and random acceleration inputs was investigated. Lumped mass models were postulated to describe the mount response to sinusoidal inputs. These models reduced the mount characteristics to a single parameter, the stiffness. Experimental investigation showed a wide range of stiffnesses for existing mounts in service so these models were considered unsatisfactory. A linear system model was postulated to describe the mount response to random input. Experimental investigation showed that non-isolated mounts have magnification factors near unity on an average basis but that individual points may have significantly higher g levels. (Modified author abstract) GRA

N74-21578# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SEVERAL APPROACHES IN THE SOLUTION OF PROBLEMS OF THE BENDING OF PLATES AND SHELLS WITH PHYSICAL AND GEOMETRIC NONLINEARITY TAKEN INTO ACCOUNT
M. S. Ganeeva 15 Jan. 1974 13 p refs Transl. into ENGLISH from Issled. Teorii Plastin Obolochek (USSR), V. 9, 1972 p 270-278
(AD-774408; FTD-HT-23-350-74) Avail: NTIS CSCL 20/11

The relationship between stresses and strains in a nonlinear elastic body are discussed in terms of shear and tensors. Formulas are derived for determining (1) variations in curvatures for sloping shells, (2) lateral strain, and (3) nonlinearity of the medium. Values of deflection and radial stresses for large axisymmetric deflections of a circular plate with a sloping spherical dome are tabulated. F.O.S.

N74-21579# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.
LINEAR DYNAMIC ANALYSES OF LAMINATED PLATES AND SHELLS BY THE HYBRID-STRESS FINITE-ELEMENT METHOD Final Report
Sheng Taur Mau and Theodore H. H. Pian Oct. 1973 231 p refs
(Contract DAAG46-73-C-0090; DA PROJ. 1B0-62113-A-661) (AD-774296; ASRL-TR-172-2; AMMRC-CTR-73-40) Avail: NTIS CSCL 20/11

Two methods of analyzing laminated-composite, linear-elastic plate and shell structures under transient mechanical and/or thermal loadings have been developed based on the hybrid-stress finite-element model. The computer codes corresponding to these two methods were also developed and tested. In the first method, involving the direct time integration of the governing equations, a central-difference scheme is used. The second method involves the modal superposition of the solution, and a sub-space iteration scheme is used to determine the normal modes. Both programs are capable of treating thin or thick plates and shell structures. Shells with branches and cutouts can be treated. The basic element used is a quadrilaterial multi-layer flat plate hybrid-stress element with eight different versions for different modeling situations. The material for each layer can be orthotropic with any arbitrary orientation. The program input and output are accomplished through several user-interactive subroutines to achieve maximum flexibility. (Modified author abstract) GRA

N74-21580# California Univ., San Diego. Dept. of Applied Mechanics and Engineering.
A VARIATIONAL PRINCIPAL, THE FINITE ELEMENT METHOD, AND OPTIMAL STRUCTURAL DESIGN FOR GIVEN DEFLECTION
G. A. Hegemier and H. T. Tang Dec. 1973 31 p refs
(Grant AF-AFOSR-1957-70; AF Proj. 9782)
(AD-774659; AFOSR-74-0151TR; TR-11) Avail: NTIS CSCL 13/13

The report is concerned with the minimum weight design of elastic structures with deflection constraints. A variational principle is derived from which optimality (necessary) criteria can be obtained in one-dimensional (beams, trusses, frames, etc.), two-dimensional (plates, shells, etc.), or three-dimensional cases. The principle is particularly well suited for problems involving single or multiple pointwise deflection constraints. The use of a variational principle suggests the finite element method as a practical computational technique. In combination with an iterative scheme, the efficacy of the approach is demonstrated for solid and sandwich plates under general load and a deflection constraint at an arbitrary point within the plate domain.
Author (GRA)

N74-21581# Tennessee Technological Univ., Cookeville. Dept. of Engineering Science.
HIGH-VELOCITY LIQUID IMPACT DAMAGE Progress Report
Ray Kinslow, Dallas G. Smith, and Vireshwar Sahai Jan. 1974 105 p refs
(Contract DAAH01-72-C-0375)
(AD-774275; TTU-ES-74-1) Avail: NTIS CSCL 11/2

Rain erosion poses a serious threat to the structural integrity and the electromagnetic performance of ceramic radomes. This progress report outlines some of the research directed toward an understanding of the mechanics of rain erosion of materials traveling at supersonic speeds. A jet gun capable of accelerating short jets of water to speeds of 5000 ft/sec is described. The volumes of craters in slip-cast fused silica targets are found to vary with the 1.44 power of the kinetic energy of the impinging jet. The pressure distribution across the impacted area of the target has been measured and found to approximate a normal Gaussian distribution with the maximum pressure at the center being equal to about 90% of the water-hammer pressure. Oblique and multiple impacts, stress waves, and spallation are discussed. Author (GRA)

N74-21582# North Carolina State Univ., Raleigh.
STUDIES IN DEFORMATION AND FRACTURE Final Report, 1 Aug. 1972 - 31 Dec. 1973
William W. Austin and George Mayer 15 Jan. 1974 11 p refs
(Grant DA-ARO(D)-31-124-73-G14)
(AD-774331; AROD-9730-3-MC) Avail: NTIS CSCL 20/12

The effects of crystallite orientation upon the formation of deformation bands in alpha-iron have been determined, along with the influence of crystallite orientation and size upon strength of polycrystalline iron. The application of thermomechanical processing methods to semicrystalline polymers has produced marked strengthening in bulk nylon 6/6, and several modes of fracture have been related to the thermal and mechanical history. Attempts to form aluminum-alumina composites by deformation processing procedures have proven not to be feasible. Geometrical problems and those associated with thermal expansion and residual stresses were the major sources of difficulty. GRA

N74-21131 Joint Publications Research Service, Arlington, Va.
THE SPREADING OF FATIGUE CRACKS IN NICKEL AND STEEL 1Kh18N9T
S. Ye. Gurevich and L. D. Yedidovich *In its* High Strength Nonmagnetic Alloys (JPRS-61605) 29 Mar. 1974 p 108-112

refs Transl. into ENGLISH from the publ. "Vysokoprochnyye Nemagnitnyye Splavy" Moscow, 1973 p 105-106 (For availability see N74-21117 12-17)

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N74-21583 Purdue Univ., Lafayette, Ind.
DEVELOPMENT AND EXPERIMENTAL EVALUATION OF A TECHNIQUE TO DETERMINE THE TEMPERATURE DISTRIBUTION IN SEMITRANSPARENT SOLID FROM REMOTELY SENSED SPECTRAL EMISSION DATA Ph.D. Thesis
Raymond Edward Chupp 1973 192 p
Avail: Univ. Microfilms Order No. 74-4943

The temperature distribution is determined by iteratively solving the equation governing the emerging spectral emission to recover the distribution to best match the emission data. The technique is evaluated using analytical and experimental emission data. The method is verified using experimental data by comparing recovered temperature distributions with those predicted by a heat-transfer analysis. The temperature varies almost linearly across the sample. Comparison of the recovered and predicted temperature profiles demonstrates that the technique works successfully for experimental emission data. The recovered linear profiles agreed with the predicted ones within the accuracy of the predictions. Recovered profiles with more than two unknowns deviated from the linear ones due to emission and/or optical property data error. Correcting some of the optical property data decreased the deviations. Dissert. Abstr.

N74-21584 Illinois Univ., Urbana.
THE THERMODYNAMIC PROPERTIES OF CARBON IN IRON AND IRON-MOLYBDENUM ALLOYS Ph.D. Thesis
Joseph Alphonsus Pascal Lobo 1973 117 p
Avail: Univ. Microfilms Order No. 74-4643

A Cahn RG Electrobalance has been used to determine the carbon content of iron, iron-0.48 wt. pct. molybdenum and iron-1.16 wt pct. molybdenum specimens which had been dynamically equilibrated with a series of methane-hydrogen gas mixtures of constant composition. The following equilibria were investigated: ferrite phases of the alloys at 682, 727, 753, 783, 813 and 848 C, and austenite phases of the alloys at 783, 813 and 848 C. The experimental results permitted direct calculation of the activities of carbon in the ferritic and austenitic samples, relative to graphite as unity, and of the enthalpy and entropy of solution of carbon. Dissert. Abstr.

N74-21585*# Michigan Univ., Ann Arbor. Heat Transfer Lab.
TRANSIENT BOILING HEAT TRANSFER IN SATURATED LIQUID NITROGEN AND F113 AT STANDARD AND ZERO GRAVITY
Emin Oker and Herman Merte, Jr. Oct. 1973 253 p refs
(Contract NAS8-20228)
(NASA-CR-120202; Rept-074610-52-F) Avail: NTIS HC $15.75 CSCL 20M

Transient and steady state nucleate boiling in saturated LN2 and F113 at standard and near zero gravity conditions were investigated for the horizontal up, vertical and horizontal down orientations of the heating surface. Two distinct regimes of heat transfer mechanisms were observed during the interval from the step increase of power input to the onset of nucleate boiling: the conduction and convection dominated regimes. The time duration in each regime was considerably shorter with LN2 than with F113, and decreased as heat flux increased, as gravity was reduced, and as the orientation was changed from horizontal up to horizontal down. In transient boiling, boiling initiates at a single point following the step increase in power, and then spreads over the surface. The delay time for the inception of boiling at the first site, and the velocity of spread of boiling varies depending upon the heat flux, orientation, body force, surface roughness and liquid properties, and are a consequence of changes in boundary layer temperature levels associated with changes in natural convection. Following the step increase in power input, surface temperature overshoot and undershoot occur before the steady state boiling temperature level is established. Author

N74-21586*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPERIMENTAL INVESTIGATION AT MACH 8 OF THE EFFECTS OF PROJECTIONS AND CAVITIES ON HEAT TRANSFER TO A MODEL OF THE VIKING AEROSHELL
Theodore R. Creel, Jr. Washington Apr. 1974 55 p refs
(NASA-TM-X-2941; L-9244) Avail: NTIS HC $3.75 CSCL 20M

An experimental investigation into the aerodynamic heating on a Mars entry vehicle shape with several types of local surface distortion is presented. The configurations tested were 0.033-scale models of a spherically blunted 70 deg half-angle cone with two protuberances of different length, representing the tube leading to the gas chromograph mass spectrometer, and two aeroshell-bioshield attachment points of different size. These models were tested at free-stream Reynolds numbers per meter of 3.7 million and 17 million over an angle-of-attack range from 0 to 18 deg in the Langley Mach 8 variable density hypersonic tunnel. The phase change-coating technique was used to measure heat transfer coefficient. The long protuberance caused more severe interference heating than the short protuberance for the same conditions. When the short projection was located close to the edge of the aeroshell, the interference heating was greater than that on the same projection when located near the vertex. A significant increase in heat transfer coefficient was measured only on the larger aeroshell-bioshield attachment point. Author

N74-21587*# Chrysler Corp., New Orleans, La. Space Div.
THERMAL PROTECTION SYSTEM GAP HEATING RATES OF THE ROCKWELL INTERNATIONAL FLAT PLATE HEAT TRANSFER MODEL (OH2A/OH2B)
Thomas F. Foster (Rockwell Intern., Downey, Calif.), William K. Lockman (NASA. Ames Res. Center), and William J. Grifall (Rockwell Intern., Downey, Calif.) Nov. 1973 563 p refs
(Contract NAS9-13247)
(NASA-CR-134077; DMS-DR-2035) Avail: NTIS HC $31.25 CSCL 20M

Heat transfer data for the Rockwell International Flat Plate Thermocouple Model are presented. The model simulated the Space Shuttle Vehicle Thermal Protection System. Data were recorded for locations in and around various size gaps for various gap orientation configurations. The test was conducted at Mach 5.1 for free-stream Reynolds number per foot values from 500,000 to 1,500,000. Author

N74-21588# Bureau of Mines, Albany, Oreg. Metallurgy Research Center.
LOW TEMPERATURE HEAT CAPACITY AND HIGH TEMPERATURE ENTHALPY OF TiAl3
J. M. Stuve and M. J. Ferrante 1974 12 p refs
(BM-RI-7834) Avail: NTIS HC $4.00

Thermodynamic properties were determined by the Bureau of Mines for the intermetallic compound, TiAl3. Heat capacities were obtained from 5 to 303 K by adiabatic calorimetry. The derived value of Sat 298.15 is 22.08 + or - 0.07 cal/deg-mole. Enthalpies relative to 298 K were obtained from 298 to 1,413 K by copper-block drop calorimetry. No anomalous thermal behavior was noted in the temperatures ranges investigated. Low- and high-temperature data were combined with a known enthalpy of formation at 298 K to give values of enthalpy of formation and Gibbs energy formation, 0 to 1,400 K. Author

N74-21589*# TRW Systems Group, Redondo Beach, Calif.
VARIABLE CONDUCTANCE HEAT PIPE TECHNOLOGY Final Research Report
W. T. Anderson, D. K. Edwards, J. E. Eninger, and B. D. Marcus Mar. 1974 87 p refs
(Contract NAS2-5503)
(NASA-CR-114750; TRW-13111-6060-RU-00) Avail: NTIS HC $7.50 CSCL 20M

A research and development program in variable conductance

heat pipe technology is reported. The project involved: (1) theoretical and/or experimental studies in hydrostatics, (2) hydrodynamics, (3) heat transfer into and out of the pipe, (4) fluid selection, and (5) materials compatibility. The development, fabrication, and test of the space hardware resulted in a successful flight of the heat pipe experiment on the OAO-3 satellite. A summary of the program is provided and a guide to the location of publications on the project is included. Author

N74-21590*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.

STUDY OF UNCERTAINTIES OF PREDICTING SPACE SHUTTLE THERMAL ENVIRONMENT Final Report

A. L. Fehrman and R. V. Masek 30 Jun. 1972 137 p refs (Contract NAS8-26699)

(NASA-CR-123821; MDC-E0639) Avail: NTIS HC$10.00 CSCL 20M

Quantitative estimates of the uncertainty in predicting aerodynamic heating rates for a fully reusable space shuttle system are developed and the impact of these uncertainties on Thermal Protection System (TPS) weight are discussed. The study approach consisted of statistical evaluations of the scatter of heating data on shuttle configurations about state-of-the-art heating prediction methods to define the uncertainty in these heating predictions. The uncertainties were then applied as heating rate increments to the nominal predicted heating rate to define the uncertainty in TPS weight. Separate evaluations were made for the booster and orbiter, for trajectories which included boost through reentry and touchdown. For purposes of analysis, the vehicle configuration is divided into areas in which a given prediction method is expected to apply, and separate uncertainty factors and corresponding uncertainty in TPS weight derived for each area. Author

N74-21591# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.

HEAT AND MASS TRANSFER IN AIRCRAFT PROPULSION

D. B. Spalding Dec. 1973 35 p refs

(HTS/73/55) Avail: NTIS HC $4.75

Practical problems of heat and mass transfer arising in aircraft propulsion are reviewed, and classified by reference to the structure of heat and mass transfer theory. It is argued that: (1) the problems are too multifarious to be handled by the traditional method of experiment generalized by way of dimensional analysis; (2) that the methods of classical mathematics, being restricted to linear equations and simple boundary conditions, are rarely applicable; and (3) that numerical methods of solving the governing nonlinear equations with arbitrary boundary conditions, coupled with mathematical models of turbulence, chemical kinetics and other phenomena, are potentially capable of solving the needs of the aircraft engine designer. Author

N74-21592# Lockheed Missiles and Space Co., Palo Alto, Calif.

EFFECTIVE MICROREFRIGERATOR

S. D. Glukhov and V. B. Poltaraus [1973] 6 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Mashinostr. (Moscow), no. 11, 1973 p 84-89

Avail: NTIS HC $4.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The fundamental results are presented of a theoretical analysis of an effective cycle which increases the thermodynamic efficiency of a microrefrigerator compared with the Gifford heat pump. The influence of the parameters of the microrefrigerator are analyzed, and it is shown that the form of the cycle is determined by the relationship between the degree of expansion and the coefficient of the regenerator volume. An experimental check shows an actual relative isothermal efficiency of 40 to 60%. F.O.S.

N74-21593# European Space Research and Technology Center, Noordwijk (Netherlands).

THE SPACECRAFT MOTION SYSTEM FOR ESTEC HEAT BALANCE FACILITY HBF 3

J. B. Walker Paris ESRO Dec. 1973 29 p refs

(ESRO-TM-118) Avail: NTIS HC $4.50

The design and development work involved in procuring the spacecraft motion system, which fits inside ESTEC's large heat-balance facility, HBF 3, and is designed to support the spacecraft on test are described. The spacecraft is supported inside the vacuum chamber in the solar beam, and the motion system reproduces the motions that the spacecraft will experience in orbit. The equipment is described in detail and performance figures and a summary of its data transmission characteristics are included. The associated developments are detailed, including the thermocouple reference junction, slip rings, vacuum-tight throughputs, oil-free rotating vacuum seals and dry-lubrication. Author (ESRO)

N74-21594# European Space Research Organization, Paris (France).

EXPERIMENTAL RESEARCH AND FINDING OF EXPONENTIAL LAWS FOR THE GRADIENTS OF TEMPERATURE, VELOCITY AND CO-CONCENTRATION IN HOT NITROGEN JET AND IN NITROGEN-PROPANE FLAME AT ATMOSPHERIC PRESSURE

M. Kallergis, R. F. Neubauer et al Jan. 1974 40 p refs Transl. into ENGLISH of Exptl. Untersuch. und Findung von Potenzgesetzen ueber den Verlauf von Temp., Geschwindigkeit und CO-Konzentration in einem Stickstoff-Heiss-Gasstrahl bzw. in einer Stickstoff-Propan-Flamme bei Freier Atmosphaere, DLR-FB-73-05, DFVLR, 1963

(ESRO-TT-7; DLR-FB-73-05) Avail: NTIS HC $5.00; DFVLR Porz.-Wahn: 11 DM

For the simulation of supersonic combustion, using an arc heater, a hot nitrogen jet and a nitrogen propane flame at atmospheric pressure were investigated. From the measured profiles of temperature, total pressure and CO concentration up to about 2000 K, simple exponential functions were derived describing the variation of temperature and velocity on the jet axis. An extrapolation near the nozzle produces values which are acceptable. Qualitative spectroscopic measurements show that, in the case of the nitrogen-propane flame, many radicals are formed. ESRO

N74-21595# Defense Documentation Center, Alexandria, Va.

ENERGY CONVERSION (COMBUSTION CHEMISTRY) Report Bibliography, Jan. 1949 - Nov. 1972

Feb. 1974 121 p refs

(AD-773400; DDC-TAS-74-6) Avail: NTIS CSCL 07/4

This bibliography is a compilation of 75 references on Energy Conversion (Combustion Chemistry). Corporate Author-Monitoring Agency, Subject, Title, Personal Author, Contract Number and Report Number Indexes are included. Author (GRA)

N74-21596# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

FLARE EFFECTIVENESS FACTORS: A GUIDE TO IMPROVED UTILIZATION FOR VISUAL TARGET ACQUISITION Final Report

Shelton MacLeod Nov. 1973 91 p refs

(AF Proj. 7184)

(AD-773806; AMRL-TR-73-46) Avail: NTIS CSCL 19/1

The paper extracts, integrates, and evaluates current research data that pertain to the more effective design and utilization of illuminating flares. The principal criterion of effectiveness is the improved capability for air-to-ground visual acquisition of targets. Various research techniques for gathering data on flare effectiveness have been considered and relevant factors reviewed under the major heading of candle composition, deployment, winddrift, atmosphere, target, and observer. The information contained herein is addressed to those Armed Forces personnel who study, design, and use systems involving illuminating flares for target acquisition. It provides guidance on flare effectiveness, reviews current research programs, and suggests areas requiring further investigation. Author (GRA)

N74-21597# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.

ANALYSIS AND CORRELATION OF HIGH ALTITUDE ROCKET EXHAUST PLUME EXPERIMENTAL DATA Final Report, May 1972 - Aug. 1973

Larry R. Ring, Alan W. Ratliff, A. J. McDanal, and R. J. Prozan Dec. 1973 108 p refs

(Contract F04611-72-C-0073; AF Proj. 5730)

(AD-772822; LMSC-HREC-TR-D306666; AFRPL-TR-73-74)

Avail: NTIS CSCL 21/2

Results are presented of a study for evaluating the applicability and accuracy of rocket motor and exhaust plume gasdynamic analytical models. Evaluation of these analytical models was based upon correlation of analytical predictions with experimental data obtained in the High Altitude Plume Radiation Program. The effects of oxidizer-to-fuel ratio gradients, combustion efficiency, combustion chamber mixing, nozzle throat expansion and chemistry model were ascertained. Non-continuum effects and closed form analytical techniques were also considered. (Modified author abstract) GRA

N74-21598# Photochem Industries, Inc., Fairfield, N.J.
PHOTOCHEMICAL ENHANCEMENT OF COMBUSTION AND MIXING IN SUPERSONIC FLOWS Final Report
A. E. Cerkanowicz Nov. 1973 136 p refs
(Contract F44620-70-C-0051; AF Proj. 9711)
(AD-774525; PII-3036-2; AFOSR-74-0153TR) Avail: NTIS CSCL 21/2

Initiation and combustion enhancement of gaseous (vaporized or atomized) fuel-air mixtures can be produced photochemically by ultraviolet irradiation in both stationary and flowing mixtures. This report presents a summary of the observed combustion effects and the intrinsic wavelength effects related to the photochemical combustion initiation and enhancement principle. Specific in-depth attention is given to radiant penetration into the reactant mixture, the possible use of laser sources and the role of the electronically excited oxygen atom in the photochemical processes. Analytical description of the phenomena provides correlation of the experimental results and extension of the findings to other conditions not directly observed by experiment. (Modified author abstract) GRA

N74-21599# Sheffield Univ. (England). Dept. of Chemical Engineering and Fuel Technology.
APPLICATION OF TRANSFER FUNCTION ANALYSIS TO COMBUSTION OSCILLATIONS USING WELL-STIRRED REACTOR MODELLING
Ashok K. Dhar Jul. 1973 75 p refs
(Grant AF-AFOSR-2248-72; AF Proj. 9711)
(AD-774636; HIC-207; AFOSR-74-0180TR) Avail: NTIS CSCL 21/2

Combustion in many cases is accompanied by noise, which may be due to natural turbulence of the combustion gases, or to feedback. In this project effort was concentrated on the last type of noise, i.e., feedback oscillations. These oscillations belong to a class of self-excited oscillations in which a normally steady supply of energy (the flame) is modulated through a passive feedback loop (the combustion chamber and the burner). The main object of this project was to define transfer functions for the oscillating combustion system, knowledge of which may enable one to prevent oscillations at the design stage. The major variables involved in these transfer functions have been identified and the validity of the mathematical model proposed is demonstrated. (Modified author abstract) GRA

N74-21600# Air Force Rocket Propulsion Lab., Edwards AFB, Calif.
PLUME BOUNDARY COMPUTER PROGRAM Final Report, 17 Apr. - 26 May 1972
Fred S. Andes Oct. 1973 44 p refs
(AD-774059; AFRPL-TR-73-85) Avail: NTIS CSCL 21/2

A computer program was developed from an existing approximate method for determining the profile of a free expansion jet emanating into a quiescent atmosphere. Inclusion of a scale correlation factor was also a necessary addition to the theory to achieve good compatibility between the approximate and method of characteristic (MOC) solutions. This inclusion gives excellent agreement, in the near-field, with MOC profiles for a wide range of exit Mach numbers, specific heat ratios, nozzle exit angles, and ambient-to-static pressure ratios. Author (GRA)

N74-21601# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A SHOCK TUBE STUDY OF THE IGNITION OF MIXTURES OF N2O, CO, AND N2 M.S. Thesis
Robert E. Case Dec. 1973 66 p refs
(AD-774385; GA/ME/73A-1) Avail: NTIS CSCL 21/2

A shock tube was employed to determine the ignition limit curves of three mixtures of N2O, CO, and N2. The ignition limit curve, which separates the ignition and no-ignition zones, is an experimentally determined curve plotted on temperature-pressure coordinates. The test gas mixtures of N2O, CO, N2 were ignited by the temperature rise behind the reflected shock wave for pressures in the range of 5 to 65 atmospheres. A 2-inch inside diameter constant area shock tube employing a helium driver was used to generate this reflected shock wave. Limited results were obtained on ignition delay time for each of the three gas mixtures. (Modified author abstract) GRA

34 GENERAL

Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N74-21602 Wisconsin Univ., Madison.
A PRACTICAL CATALOGING, INDEXING, AND RETRIEVAL SYSTEM FOR REMOTE SENSING DATA Ph.D. Thesis
Ramchandra Sitaram Sinch 1973 162 p
Avail: Univ. Microfilms Order No. 73-23088

A system was designed whereby the remote sensing data which includes imagery, flight-logs, ground-truth and research reports which contain raw data can be properly cataloged, indexed, and retrieved from the remote sensing user's point of view. The mechanics can be handled by a librarian with a minimal amount of orientation to remote sensing. The system is basically designed for low altitude (about 10,000 ft. or less) imagery but has the capability of being adapted for any altitude imagery or for ground, laboratory, or underwater shots and related documents containing raw data. This practical cataloging, indexing, and retrieval system for remote sensing data consists of the following: (1) A card catalog; (2) A site-index-map; and (3) site-index-file; industry-index-file; project-index-file; and catalogue cards. Dissert. Abstr.

N74-21603*# Denver Research Inst., Colo. Industrial Economics Div.
A CASE STUDY IN TECHNOLOGY UTILIZATION: INDUSTRIAL PRODUCTS AND PRACTICES
Feb. 1973 61 p refs
(Contract NASw-2362)
(NASA-CR-137985) Avail: NTIS HC $6.25 CSCL 05A

In pursuit of such missions as Apollo, the National Aeronautics and Space Administration has called into being unique equipment that obviously has little direct application beyond the achievement of mission objectives. Yet, to assume that further direct application of space program hardware is somehow a measure of the industrial benefits accruing to the nation is to misunderstand how the creation of new technology affects modern industrial capability. This document presents a profile of the significant ways in which technological developments in response to aerospace mission requirements have been coupled into industrial practice, with the result being that improved products and processes are now being utilized to benefit the nation.
Author

N74-21604*# National Aeronautics and Space Administration, Washington, D.C.
TECHNOLOGY UTILIZATION PROGRAM REPORT
1974 78 p
(NASA-SP-5119) Avail: NTIS HC $4.00 CSCL 05B

The application of aerospace technology to the solution of public health and industrial problems is reported. Data cover: (1) development of an externally rechargeable cardiac pacemaker, (2) utilization of ferrofluids-colloidal suspensions of ferrite particles - in the efficient separation of nonferrous metals as Ni, Zn, Cu, and Al from shredded automobile scrap, and (3) development of a breathing system for fire fighters. Author

N74-21605# Committee on Aeronautical and Space Sciences (U. S. Senate).
NASA AUTHORIZATION FOR FISCAL YEAR 1975.

PART 1
Washington GPO 1974 538 p refs Hearings on S. 2955 before Comm. on Aeron. and Space Sci., 93d Congr., 2d Sess., 5, 26 and Feb. 1974
Avail: Comm. on Aeron. and Space Sci.

The Congressional hearings on the NASA authorization for Fiscal Year 1975 are presented. The hearings concern appropriation of funds for research and development, construction of facilities, and program management. The projects discussed include: (1) aircraft noise abatement research, (2) civil and military short haul aircraft, (2) civil and military long haul aircraft, (3) highly maneuverable aircraft technology, (4) aeronautics fuel conservation, (5) exploration of space, and (6) energy technology for civilian needs. P.N.F.

N74-21606# Committee on Science and Astronautics (U. S. House).
NASA AUTHORIZATION, 1975, PART 2
Washington GPO 1974 1146 p refs Hearings on H.R. 12689 (superseded by H.R. 13998) before Comm. on Sci. and Astronaut., 93d Congr., 2d Sess., No. 25, 19-21 and 26-27 Feb. and 5-6 Mar. 1974
Avail: Subcomm. on Manned Space Flight
For abstract, see N74-21605.

N74-21607# Committee on Science and Astronautics (U. S. House).
FOR THE BENEFIT OF ALL MANKIND: THE PRACTICAL RETURNS FROM SPACE INVESTMENT
John A. Carstarphen Washington GPO Apr. 1974 104 p refs Presented to Comm. on Sci. and Astronaut., 93d Congr., 1st Sess., 22 Apr. 1974 Revised
(GPO-29-779) Avail: Comm. on Sci. and Astronaut.

A Congressional report on the benefits of the space program to the public through the technology utilization program is presented. The tangible benefits resulting from various space associated developments are described. During 1973 more than 2,000 new examples of space-developed innovations and techniques were reported under the NASA program. Since the inception of the technology utilization program more than 30,000 items have been reported. Specific benefits to industry, business, the national economy, and education are reported. Author

N74-21608# Environmental Protection Agency, Research Triangle Park, N.C. Air Pollution Technical Information Center.
LEAD AND ENVIRONMENT, 1972
[1973] 184 p refs Transl. into ENGLISH of "Blei und Umwelt, 1972", Bundesgesundheitsamtes, Komm. fuer Umweltgefahren, Arbeitsgruppe Blei, Berlin, 1972 111 p
(TR-546-73) Avail: NTIS HC $12.25

Articles and discussions concerning the field of air pollution caused by lead in the environment are presented. The problem of lead pollution produced by automobile exhaust gases is of primary interest. Other subjects discussed are: (1) lead content of water, (2) lead permeability of glazed porcelain, (3) lead content of foods, (4) physiolgical effects of lead pollution, and (5) lead damage prevention in the metal working industry. Author

N74-21609# Executive Office of the President, Washington, D.C.
AERONAUTICS AND SPACE REPORT OF THE PRESIDENT, 1973 ACTIVITIES
1973 136 p
Avail: NTIS MF $1.45; SOD HC $1.70

The space and aeronautical activities of federal departments and agencies are summarized. Technologies for acquiring and analyzing information about the earth, its environment, and its resources from aircraft and spacecraft are outlined. The Earth Resources Technology Satellite is an example of this type of research. Progress in understanding man's ability to live and work in space for extended periods is discussed. Defense activities include further development and implementation of satellite based communications and navigation systems, development of new military aircraft, and construction of Advanced Medium STOL Transport Prototypes, which may be used for civil transport as well. The development, operation and support of civil and military space applications such as meteorology, communications, and earth observations is also discussed. Author

N74-21610# Advisory Group for Aerospace Research and Development, Paris (France).
AGARD ANNUAL MEETING, 1973
Dec. 1973 68 p refs In ENGLISH; partly in FRENCH Conf. held at Athens, 13 Sep. 1973
Avail: NTIS HC $6.50

Conference papers are presented which relate to: (1) research and development activities in Greece, and (2) the use of science and technology to meet military requirements at reduced costs. For individual titles, see N74-21611 through N74-21618.

N74-21611 Advisory Group for Aerospace Research and Development, Paris (France).
RESEARCH AND DEVELOPMENT ACTIVITIES IN GREECE
S. N. Moraitis (Hellenic Air Force) *In its* AGARD Ann. Meeting, 1973 Dec. 1973 p 8-13 (For availability see N74-21610 12-34)

An overview is presented of the distribution of research efforts in Greece according to the areas of activity and expenditures. Tables are given which illustrate the following: (1) the activities which contributed to the formation of the national income for the years 1970 through 1972, and secondly the forecasts for 1987; (2) the country's gross domestic asset formation per field of productive activity; (3) electric power exploitation as achieved by the Public Power Corporation; (4) the structure of domestic asset formation in the industrial enterprises for four categories of products; (5) distribution of expenditures for types of research and the percent of the gross national product represented by the total research expenditure; and (6) the financing of research and development according to the performing agency for the current five year program which runs from 1973 to 1977. D.L.G.

N74-21612 Athens Univ. (Greece).
ELECTRONICS AND SPACE ACTIVITIES IN GREECE
K. Anastassiades *In* AGARD AGARD Ann. Meeting, 1973 Dec. 1973 p 14-17 In ENGLISH and FRENCH (For availability see N74-21610 12-34)

The role of electronics and space activities in scientific research is discussed. Emphasis is placed on a study of wave propagation conditions between two points in magnetic conjunction; Athens and Salisbury, Rhodesia. Some results are presented which were obtained in a special space research program to study the overall electron content simultaneously between the two points. The results were observed during the solar eclipse of 30 June 1973. D.L.G.

N74-21613 Societe Nationale Industrielle Aerospatiale, Paris (France).
TECHNIQUES ORIENTED TOWARDS COST REDUCTION
M. Chevalier *In* AGARD AGARD Ann. Meeting, 1973 Dec. 1973 p 22-27 In ENGLISH and FRENCH (For availability see N74-21610 12-34)

It is pointed out that, parallel to the continuous improvement in performance regarding aircraft construction, actions are currently being developed towards simpler materials, open to quantity production, and characterized by a determined tendency towards economy. Three aspects are dealt with concerning the vehicle production; (1) structure, (2) power plants, and (3) equipment. Author

N74-21614 National Aerospace Lab., Amsterdam (Netherlands).
TECHNICAL AND OPERATIONAL ASPECTS OF EXTERNALLY-MOUNTED AIRCRAFT EQUIPMENT **c02**
T. VanOosterom *In* AGARD AGARD Ann. Meeting, 1973 Dec. 1973 p 29-34 (For availability see N74-21610 12-34)

It is pointed out that the installation of additional equipment in an aircraft is often impossible due to space limitations. Consideration is given the choice which must be made between redesigning or modifying the fuselage, or housing the equipment in an external speedpack or pod. Several advantages of a pod-mounted system are indicated and specific design aspects which may require advanced applications of science and technology are discussed. It is concluded that the pod concept has the potential to solve, in many cases, the problems inherent in the implementation of new operational equipment within the inventory of an air force. It is also concluded that for many

applications the pod concept will have a superior operational cost effectiveness in comparison with an aircraft-integrated system. Author

N74-21615 Ministry of Defence, London (England).
THE REDUCTION OF AIRFRAME COSTS WITH PARTICULAR REFERENCE TO COMBAT AIRCRAFT c02
J. Seddon *In* AGARD AGARD Ann. Meeting, 1973 Dec. 1973 p 34-39 (For availability see N74-21610 12-34)

It is stated that for modern aircraft weapon systems such as a multi-role combat aircraft, cost reduction can be achieved at all stages of the procurement process, and by a wide variety of means. Some examples are presented of recent achievements in the following three phases: aerodynamic and structural design, mechanical and physical engineering, and manufacturing technology. Author

N74-21616 Ministry of Defence (West Germany).
THE HINGELESS ROTOR: A CONCEPT TO INCREASE MISSION EFFECTIVENESS AT REDUCED COSTS c02
R. Barth *In* AGARD AGARD Ann. Meeting, 1973 Dec. 1973 p 40-50 refs (For availability see N74-21610 12-34)

The mechanical simplification of helicopters by elimination of blade attachment hinges is discussed. Emphasis is placed on the Bolkow system which features fiberglass rotor blades of high elasticity rigidly attached to a stiff hub. The stated advantages of the system are: (1) The hingeless rotor design needs only about 30 percent of the parts of an articulated rotor. (2) Control becomes more powerful, faster and more direct, and nearly independent of thrust. (3) The rotor blades can offer more than 10,000 hours of service life compared to 1,000 to 2,000 hours for comparable helicopters. (4) The fiberglass material is corrosion proof and tests have shown that it is insensitive to notches. (5) The hingeless rotor is most promising in fulfilling modern military requirements for air mobility. D.L.G.

N74-21617 Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).
RESEARCH WORK AND COSTS, THE ROLE OF DATA PROCESSING
P. Bohn *In* AGARD AGARD Ann. Meeting, 1973 Dec. 1973 p 51-53 In ENGLISH and FRENCH (For availability see N74-21610 12-34)

An overview is presented on research work and costs in aircraft manufacturing with emphasis placed on the changes which have taken place as a result of the introduction of powerful computers. It is pointed out that computers provide a means to improve the modelling of physical phenomena and to demonstrate the resulting effects on the whole aircraft. Aircraft manufacturers are now in a position to achieve trade-offs which were at one time inconceivable, especially as far as costs are concerned. It is predicted that in the future, research work will require more highly trained engineers, extremely powerful computers, and very bulky data files. These requirements are based on: (1) In-flight development time is becoming increasingly short, and is devoted more and more either to the development of electronic systems, or to the analysis of abnormal flight patterns or failure investigations. (2) Official agencies and industrial firms everywhere must more and more frequently accept contracts for the development of prototypes. (3) Optimization, Obtained by computers, permits the manufacturer to simplify without incurring any penalties as regards the objectives. D.L.G.

N74-21618 Air Force Systems Command, Wright-Patterson AFB, Ohio.
IMPACT OF TECHNOLOGY ON COST REDUCTION
John F. Brooke *In* AGARD AGARD Ann. Meeting, 1973 Dec. 1973 p 53-60 (For availability see N74-21610 12-34)

The results are discussed of a United States Air Force survey conducted to identify those technologies which hold the greatest promise of reducing life-cycle costs. The analysis indicates that the cost reducing aspects of seventeen identified technologies could achieve a ten year life-cycle savings on the order of $450 million. Five of these technologies, considered to be representative examples, are discussed in detail and include: (1) advanced composites, (2) weldbond joining, (3) metal working and munitions, (4) replaceable tread tire concept, and (5) aircraft battery technology. D.L.G.

N74-21619# Mitre Corp., McLean, Va.
BACKGROUND MATERIAL FOR THE ENERGY POLICY WORKSHOP, 11-12 JANUARY 1973
Richard S. Greeley Feb. 1973 79 p
(M73-12) Avail: NTIS HC $7.00

A specific set of energy policies focused on achieving competitive fuel prices, increased domestic fuel supplies, and environmental protection is discussed. A set of charts containing background information on current and projected fuels availabilities and prices and a narrative discussion of each one is presented. Author

N74-21620# Committee on Interior and Insular Affairs (U. S. Senate).
CONSERVATION OF ENERGY
Washington GPO 1972 121 p refs Presented to Comm. on Interior and Insular Affairs, 92d Congr., 2d Sess., 1 Aug. 1972 Prepared by Library of Congr.
Avail: SOD HC $0.50

The following topics relating to the conservation of energy resources are discussed. (1) The dependence of the United States on foreign supplies of oil and gas, and the extent to which energy conservation can provide greater national security through the reduction of imports. (2) The economic and technical feasibility of extending the use of available fuel reserves over a longer period of time through more efficient use of production and controls. (3) The consequences of a comprehensive federal program for energy conservation, considering the fact that existing policy is based on the premise that federal and state regulations should encourage industry to meet whatever demands are created in the marketplace. (4) The extent to which advances in finding new energy sources, i.e., solar, breeder, or controlled thermonuclear, will lessen the need for energy conservation. Author

N74-21621# National Bureau of Standards, Washington, D.C. Heat Div.
CRYOGENIC PHYSICS SECTION, SUMMARY OF ACTIVITIES, 1973 Interim Report, 1 Jan. - 31 Dec. 1974
R. J. Soulen, Jr., ed. Mar. 1974 25 p refs
(NBS-TN-823) Avail: SOD HC $0.60 as C13.46:823

The research activities which specifically relate to thermometry are summarized. The topics range from superconductive fixed points to nuclear orientation thermometry, as well as Josephson junction noise thermometry and paramagnetism. Author

N74-21622# Bureau of Mines, Washington, D.C.
TECHNOLOGIC AND RELATED TRENDS IN THE MINERAL INDUSTRIES, 1972
1973 47 p refs
(BM-IC-8603) Avail: NTIS HC $5.50

Methods, equipment, techniques, and systems used to more effectively extract and process minerals and fuels are discussed. Environmental considerations, reduced ore grades, and the related increased quantities of material handled were the dominant concerns of the minerals industry in 1972. Productivity increased in most mineral commodities as equipment became more mobile, versatile, and sophisticated. Increasingly, equipment designs incorporated health and safety features. There was considerable interest in the field of energy and in pollution-free metallurgy processes. Author

N74-21623*# George Washington Univ., Washington, D.C.
TRENDS IN STATE AND FEDERAL LAND USE LAW RELATING TO INVENTORIES, MONITORING AND EVALUATION Final Report
Charles M. Lamb 31 Mar. 1974 83 p refs
(Grant NGL-09-010-030)
(NASA-CR-137332) Avail: NTIS HC $7.25 CSCL 05D

This study surveys selected state and federal land use laws, focusing mainly on provisions for inventories, monitoring and evaluation. The first portion of the survey includes fifteen states. Particular emphasis is placed on land use statutes and practices in Hawaii, Vermont, Colorado, Florida, and Maine. Interviews with several state planning directors were also conducted to determine the degree of implementation, adequacy of funding, effectiveness of state land use control to date, and general attitudes toward trends in federal land use law. Then, federal land use legislation since 1961 is broadly discussed. The examination specifically ana-

lyzes provisions of the Coastal Zone Management Act of 1972, the Rural Development Act of 1972, and the proposed Land Use Policy and Planning Assistance Act. Finally, the author addresses the topics of rapid changes in recent land use control, and some effects of federal statutes on land use management by state and local governments. Author

N74-21624# Joint Economic Committee (U. S. Congress).
THE GASOLINE AND FUEL OIL SHORTAGE From the Subcommittee on Consumer Economics
Washington GPO 1973 295 p refs Hearings before Joint Econ. Comm., 93d Congr., 1st Sess., 1-2 May and 2 Jun. 1973
(GPO-99-740) Avail: SOD HC $2.00

A Congressional hearing on the gasoline and fuel oil shortage is presented. The impact of the shortages on the overall economy of the nation is analyzed. The outlook for the fuel situation in the period 1972 through 1975 is examined. Methods for correcting the fuel shortage are proposed. The government policy with respect to resources management and fuel allocations is discussed. The economic condition and operating problems of various gasoline and oil companies are reported by selected representatives from these companies. P.N.F.

N74-21625# Committee on Interstate and Foreign Commerce (U. S. House).
TRANSPORTATION CONTROLS UNDER THE CLEAN AIR ACT
Washington GPO Sep. 1973 64 p refs Presented to Comm. on Interstate and Foreign Com., 93d Congr., 1st Sess., Sep. 1973
(GPO-20-345) Avail: Subcomm. on Public Health and Environment

A Congressional investigation of the provisions of the Clean Air Act and the effects on various parts of the economy, especially the transportation aspects, was conducted. The subjects discussed are: (1) Environmental Protection Agency, (2) reaction to proposed transportation control strategies, (3) relationship between new car emission standards and transportation control requirements, and (5) energy implications of transportation controls. The majority of the information consists of testimony from selected persons with expertise in the environmental protection subjects. P.N.F.

N74-21626# Atomic Energy Commission Research Establishment, Riso (Denmark). Dept. of Physics.
[PROGRESS IN SOLID STATE PHYSICS, PLASMA PHYSICS, METEOROLOGY, AND LIQUID N2 AND He PLANTS] Annual Progress Report, 1 Jan. - 31 Dec. 1972
H. B. Moeller, ed. and C. J. Christensen, ed. Mar. 1973 63 p refs
(RISO-288) Avail: AEC Depository Libraries HC $5.25

Research on solid state physics, plasma physics, nuclear spectroscopy, and meteorology is summarized. NSA

N74-21627# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
AIR FORCE CAMBRIDGE RESEARCH LABORATORIES REPORT ON RESEARCH Interim Report, 1 Jul. 1970 - 30 Jun. 1972
John F. Dempsey Feb. 1973 381 p refs
(AF Proj. 9993)
(AD-774743; AFCRL-TR-73-0384; AFCRL-SR-163) Avail: NTIS CSCL 05/2

This is the sixth in a series of Reports on Research at the Air Force Cambridge Research Laboratories. The report covers a two-year interval. The work of each of the laboratories is discussed as a separate chapter. Additionally, the report includes an introductory chapter on AFCRL management and logistic activities related to the reporting period. The laboratories are the following: The Air Force Cambridge Research Laboratories; Aeronomy Laboratory; Microwave Physics Laboratory; Aerospace Instrumentation Laboratory; Space Physics Laboratory; Meteorology Laboratory; and Sacramento Peak Observatory, Terrestrial Sciences Laboratory, Optical Physics Laboratory, Ionospheric Physics Laboratory, Solid State Sciences Laboratory. GRA

N74-21628# Informatics, Inc., Rockville, Md.
SELECTED MATERIAL FROM SOVIET TECHNICAL LITERATURE, JULY 1973
Stuart G. Hibben 24 Sep. 1973 92 p refs
(Contract F44620-72-C-0053; ARPA Order 1622-4)
(AD-774460; AFOSR-74-0132TR) Avail: NTIS CSCL 05/2

The report includes abstracts and bibliographic lists on contractual subjects that were completed in July, 1973. The major topics are: laser technology, effects of strong explosions, geosciences, particle beams, material sciences, an miscellaneous interest items. A section on atmospheric physics is being published separately. Laser coverage is generally limited to high power effects; all current laser material is routinely entered in the quarterly laser bibliographies. An index identifying source abbreviations and a first-author index to the abstracts are appended. Author (GRA)

N74-21629# Battelle Columbus Labs., Long Beach, Calif. Research Facility.
SHIP-HELICOPTER SYSTEM ANALYSIS Final Report, 16 May - 30 Nov. 1973
R. A. Egen, J. C. Minor, and H. A. Cress 7 Dec. 1973 41 p refs
(Contract DOT-CG-23223-A)
(AD-774764; USCG-D-44-74) Avail: NTIS CSCL 13/10

The objective of the report is to identify limitations to Coast Guard ship-helicopter (ship/helo) operations on WMEC and WHEC class vessels, and to study possible ways to remove these limitations to increase ship/helo utilization. A systems analysis technique was used to identify and describe the interrelationships among the system elements which affect ship/helo operations. Inherent limitations of ships and helicopters are described, as well as possible missions and modes of combined operations. Special consideration is given to the HARPOON, BEARTRAP, and SHAG helicopter rapid-securing and release systems. (Modified author abstract) GRA

N74-21258 Joint Publications Research Service, Arlington, Va.
FIFTEENTH ANNIVERSARY OF THE CONQUERING OF THE POLE OF RELATIVE INACCESSIBILITY
Ye. I. Tolstikov *In its* Meteorol. and Hydrol., No. 1, 1974 (JPRS-61729) 11 Apr. 1974 p 173-179 Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 1, 1974 p 111-114 (For availability see N74-21239 12-20)

N74-21272 Joint Publications Research Service, Arlington, Va.
EFFICIENCY OF THE HYDROMETEOROLOGICAL SERVICING OF THE NATIONAL ECONOMY
S. K. Cherkavskiy *In its* Meteorol. and Hydrol., No. 12, 1973 (JPRS-61632) 1 Apr. 1974 p 117-125 Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 12, 1973 p 93-97 (For availability see N74-21259 12-20)